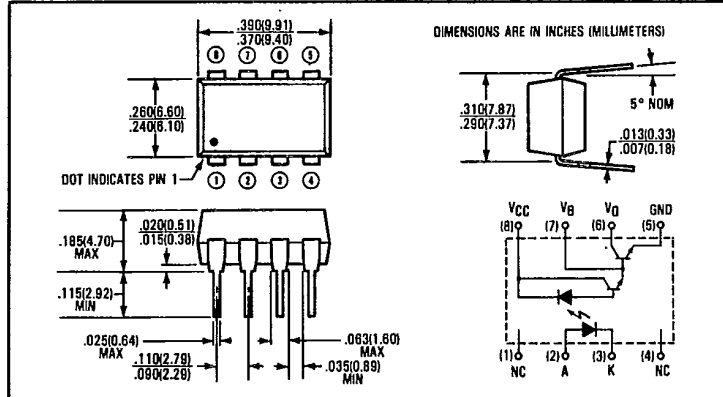
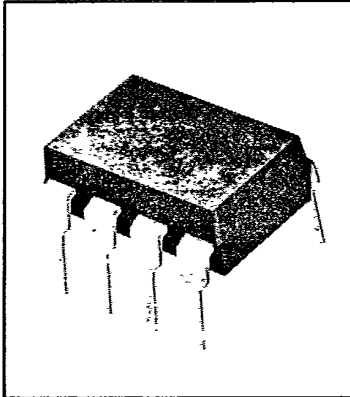


High Gain Optocouplers

Types 6N138, 6N139



Features

- High CTR
- Low drive current required
- TTL compatible
- 3000 V isolation
- High output current
- High common mode rejection
- U.L. Recognized, File No. E58730

Description

GaAsP emitters are coupled with high gain integrated photodetectors to provide good sensitivity at low input currents. A photodiode drives two transistor stages to provide good speed performance with an open collector output capable of interface to TTL. Alternatively, the two collectors can be externally connected for darlington operation.

The 6N139 is suitable for CMOS or LTTL applications with a 400% minimum CTR at 0.5 mA input drive.

The 6N138 is for use in TTL applications with a minimum CTR of 300% at 1.6 mA input. This allows TTL in and TTL out when used with a 2.2 kΩ pull-up resistor.

Absolute Maximum Ratings* (No derating required up to 70°C)

Storage Temperature	-55°C to +125°C
Operating Temperature	0°C to +70°C
Lead Soldering Temperature (1/16 inch [1.6 mm] from case for 10 seconds)	280°C
Average Input Current - I _F	20 mA ⁽¹⁾
Peak Input Current - I _F (50% duty cycle, 1 ms pulse width)	40 mA
Peak Transient Input Current - I _F (≤ 1 μs pulse width, 300 pps)	1.00 A
Reverse Input Voltage - V _R	5.0 V
Input Power Dissipation	35 mW ⁽²⁾
Output Current - I _O	60 mA ⁽³⁾
Emitter-Base Reverse Voltage	0.50 V
Supply and Output Voltage - V _{CC} , V _O	0.50 V
6N138	-0.50 V to 7.0 V
6N139	-0.50 V to 18.0 V
Output Power Dissipation	100 mW ⁽⁴⁾

* JEDEC Registered Data

Notes:

- (1) Derate linearly above 50°C free-air temperature at a rate of 0.4 mA/°C.
- (2) Derate linearly above 50°C free-air temperature at a rate of 0.7 mW/°C.
- (3) Derate linearly above 25°C free-air temperature at a rate of 0.7 mA/°C.
- (4) Derate linearly above 25°C free-air temperature at a rate of 2.0 mW/°C.

Caution: This component is susceptible to damage from electrostatic discharge. Normal static prevention procedures should be used in handling.

Types 6N138, 6N139

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Electrical Characteristics Over recommended temperature (TA = 0°C to 70°C), unless otherwise noted

Symbol	Parameter	Device	Min.	Typ.**	Max.	Units	Test Conditions	Figure
CTR*	Current Transfer Ratio	6N139	400 500	800 900		%	IF=0.50 mA, VO=0.40 V, VCC=4.5 V IF=1.60 mA, VO=0.40 V, VCC=4.5 V	3
		6N138	300	600		%	IF=1.60 mA, VO=0.40 V, VCC=4.5 V	
VOL	Logic Low Output Voltage	6N139		0.100 0.100 0.20	0.40 0.40 0.40	V	IF=1.60 mA, IO=6.4 mA, VCC=4.5 V IF=5.0 mA, IO=15.0 mA, VCC=4.5 V IF=12.0 mA, IO=24 mA, VCC=4.5 V	
		6N138		0.100	0.40	V	IF=1.60 mA, IO=4.8 mA, VCC=4.5 V	
IOH*	Logic High Output Current	6N139		0.050	100	μA	IF=0 mA, VO=VCC=18.0 V	
		6N138		0.100	250	μA	IF=0 mA, VO=VCC=7.0 V	
ICCL	Logic Low Supply Current			0.20		mA	IF=1.60 mA, VO=Open, VCC=5.0 V	
ICCH	Logic High Supply Current			10.0		nA	IF=0 mA, VO=Open, VCC=5.0 V	
VF*	Input Forward Voltage			1.40	1.70	V	IF=1.60 mA, TA=25°C	4
BVR*	Input Reverse Breakdown Voltage		5.0			V	IR=10.0 μA, TA=25°C	
$\frac{\Delta V_F}{\Delta I_A}$	Temperature Coefficient of Forward Voltage			-1.80		mV/°C	IF=1.60 mA	
CIN	Input Capacitance			60		pF	f=1.00 MHz, VF=0	
II-O*	Input-Output Insulation Leakage Current				1.00	μA	45% Relative Humidity, TA=25°C t=5.0 s, VI-O=3000 VDC	
RI-O	Input-Output Resistance			10 ¹²		Ω	VI-O=600 VDC	
CI-O	Input-Output Capacitance			0.60		pF	f=1.00MHz	



Switching Specifications (TA = 25°C)

tPHL*	Propagation Delay Time	6N139		5.0 0.20	25 1.00	μs	IF=0.50 mA, RL=4.7 kΩ IF=12.0 mA, RL=270 Ω	7
		6N138		1.00	10.0	μs	IF=1.60 mA, RL=2.2 kΩ	
tPLH*	Propagation Delay Time	6N139		5.0 1.00	60 7.0	μs	IF=0.50 mA, RL=4.7 kΩ IF=12.0 mA, RL=270 Ω	7
		6N138		4.0	35	μs	IF=1.60 mA, RL=2.2 kΩ	
CMH	Common Mode Transient Immunity at Logic High Level Output			500		V/μs	IF=0 mA, RL=2.2 kΩ, RCC=0 (Vcm)=10.0 Vp-p (See Note 5)	10
CML	Common Mode Transient Immunity at Logic Low Level Output			-500		V/μs	IF=1.60 mA, RL=2.2 kΩ, RCC=0 (Vcm)=10.0 Vp-p (See Note 6)	10

* JEDEC Registered Data. ** All typicals at TA=25°C and VCC=5 V, unless otherwise noted.

Notes:

- CMH is the maximum allowable dv/dt on the leading edge of a common mode pulse to assure that the output will not switch from high to low.
- CML is the maximum negative dv/dt allowable on the trailing edge of a common mode pulse to assure that the output will not switch from low to high.

Types 6N138, 6N139

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Figure 1. 6N139 DC Transfer Characteristics

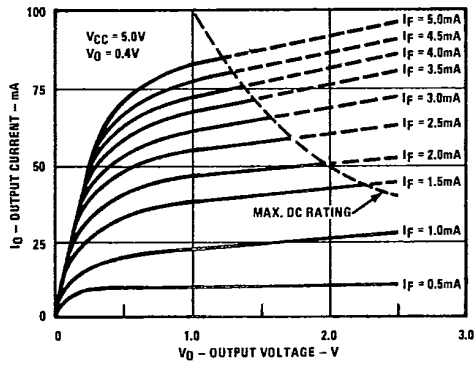


Figure 2. 6N138 DC Transfer Characteristics

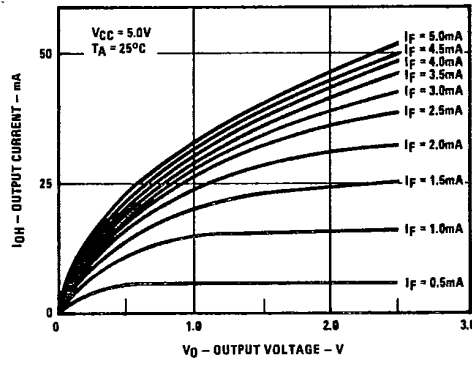


Figure 3. Current Transfer Ratio vs Forward Current

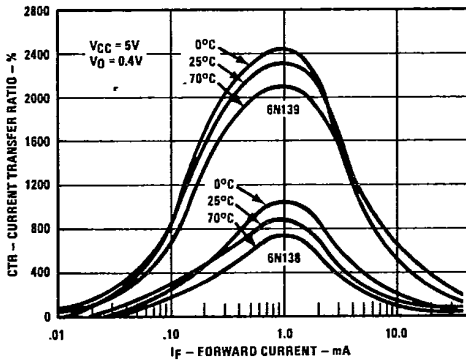


Figure 4. Input Diode Forward Current vs Forward Voltage

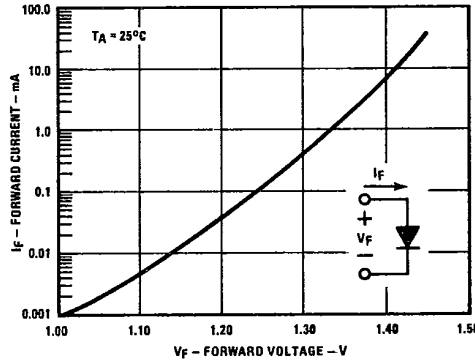


Figure 5. 6N139 Output Current vs Input Diode Forward Current

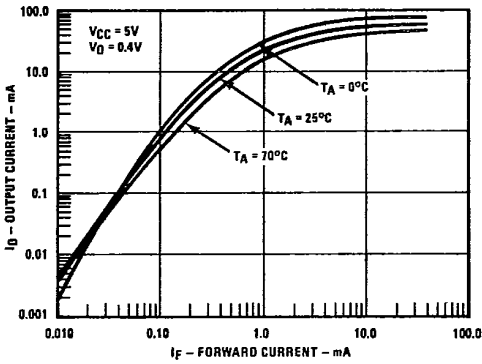
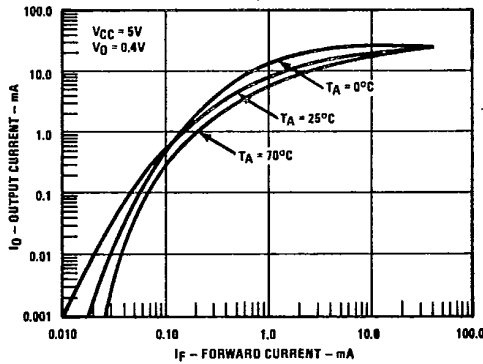


Figure 6. 6N138 Output Current vs Input Diode Forward Current



Types 6N138, 6N139

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Figure 7. Propagation Delay vs Temperature

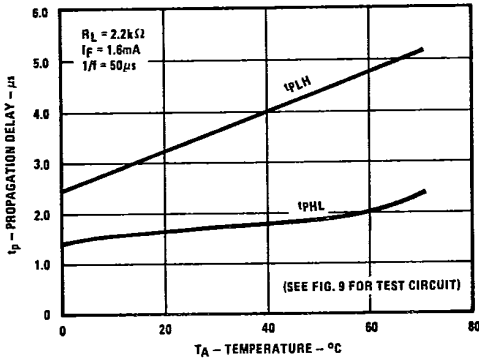


Figure 8. Non Saturated Rise and Fall Time vs Load Resistance

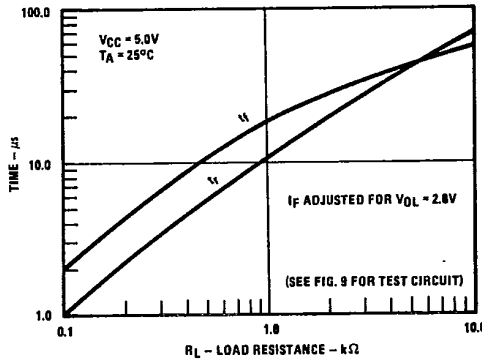
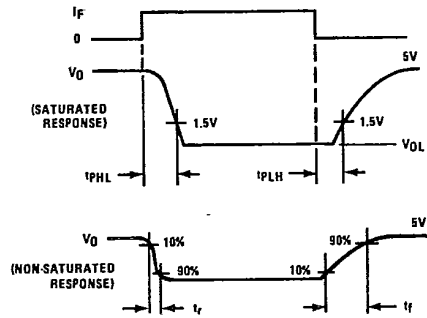
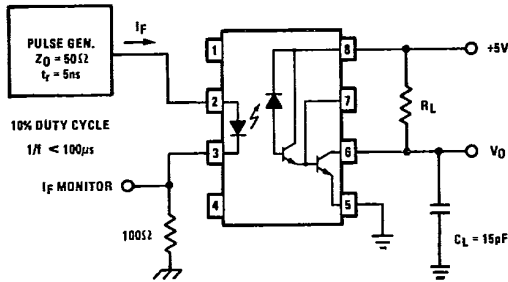


Figure 9. Switching Time Test Circuit



*JEDEC Registered Data.

Figure 10. Test Circuit for Transient Immunity and Typical Waveforms

