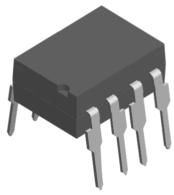
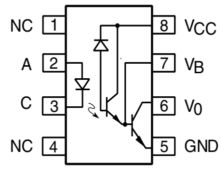
High Speed Optocoupler, 100 kBd, Low Input Current, Photodiode Darlington Output

Features

- High Current Transfer Ratio, 300 %
- Low Input Current, 0.5 mA
- High Output Current, 60 mA
- Isolation Test Voltage, 5300 V_{RMS}
- TTL Compatible Output, V_{OL} = 0.1 V
- High Common Mode Rejection, 500 V/µs
- Adjustable Bandwidth-Access to Base
- Standard Molded Dip Plastic Package
- Lead-free component





i179082

- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Agency Approvals

- UL1577, File No. E52744 System Code H or J, Double Protection
- DIN EN 60747-5-2 (VDE0884)
  DIN EN 60747-5-5 pending
  Available with Option 1

Applications

Logic Ground Isolation-TTL/TTL, TTL/CMOS, CMOS/CMOS, CMOS/TTL

EIA RS 232 Line Receiver

Low Input Current Line Receiver-Long Lines,Party Lines

Telephone Ring Detector

117 VAC Line Voltage Status Indication-Low Input Power Dissipation

Low Power Systems-Ground Isolation

Description

High common mode transient immunity and very high current ratio together with 5300 V_{RMS} insulation are achieved by coupling and LED with an integrated high gain photo detector in an eight pin dual-in-line package. Separate pins for the photo diode and output stage enable TTL compatible saturation voltages with high speed operation.

Photo darlington operation is achieved by tying the V_{CC} and V_O terminals together. Access to the base terminal allows adjustment to the gain bandwidth.

The 6N138 is ideal for TTL applications since the 300 % minimum current transfer ratio with an LED current of 1.6 mA enables operation with one unit load-in and one unit load-out with a 2.2 kΩ pull-up resistor.

The 6N139 is best suited for low power logic applications involving CMOS and low power TTL. A 400 % current transfer ratio with only 0.5 mA of LED current is guaranteed from 0 °C to 70 °C

Caution: Due to the small geometries of this device, it should be handled with Electrostatic Discharge (ESD) precautions. Proper grounding would prevent damage further and/or degradation which may be induced by ESD.

Order Information

Part	Remarks
6N138	CTR > 300 %, DIP-8
6N139	CTR > 500 %, DIP-8
6N138-X007	CTR > 300 %, SMD-8 (option 7)
6N138-X009	CTR > 300 %, SMD-8 (option 9)
6N139-X007	CTR > 500 %, SMD-8 (option 7)
6N139-X009	CTR > 500 %, SMD-8 (option 9)

For additional information on the available options refer to Option Information.

Absolute Maximum Ratings

T_{amb} = 25 °C, unless otherwise specified
Stresses in excess of the absolute Maximum Ratings can cause permanent damage to the device. Functional operation of the device is not implied at these or any other conditions in excess of those given in the operational sections of this document. Exposure to absolute Maximum Rating for extended periods of the time can adversely affect reliability.

Input

Parameter	Test condition	Symbol	Value	Unit
Reverse voltage		V_R	5.0	V
Forward current		I_F	25	mA
Average input current		$I_{F(AVG)}$	20	mA
Input power dissipation [1), 3)]		P_{diss}	35	mW

Output

Parameter	Test condition	Part	Symbol	Value	Unit
Supply and output voltage	pin 8-5, pin 6-5	6N138	V_{CC}, V_O	- 0.5 to 7.0	V
	pin8-5, pin 6-5	6N139	V_{CC}, V_O	- 0.5 to 18	V
Emitter base reverse voltage	pin 5-7			0.5	V
Peak input current	50 % duty cycle - 1.0 ms pulse width			40	mA
Peak transient input current	$t_p \leq 1.0$ µs, 300 pps			1.0	A
Output current	pin 6		I_O	60	mA
Output power dissipation [2), 4)]			P_{diss}	100	mW

Coupler

Parameter	Test condition	Symbol	Value	Unit
Isolation test voltage		V_{ISO}	5300	V_{RMS}
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 ° C	R_{IO}	$\geq 10^{12}$	Ω
	V_{IO} = 500 V, T_{amb} = 100 ° C	R_{IO}	$\geq 10^{11}$	Ω
Storage temperature		T_{stg}	- 55 to + 125	°C
Operating temperature		T_{amb}	- 55 to + 100	°C
Lead soldering temperature	t = 10 s	T_{sld}	260	°C

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

Electrical Characteristics

T_{amb} = 25 °C, unless otherwise specified
Minimum and maximum values are testing requirements. Typical values are characteristics of the device and are the result of engineering evaluation. Typical values are for information only and are not part of the testing requirements.

Input

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Input forward voltage	I_F = 1.6 mA	V_F		1.4	1.7	V
Input reverse breakdown voltage	I_R = 10 µA	BV_R	5.0			V
Temperature coefficient of forward voltage	I_F = 1.6 mA			- 1.8		mV/°C

Output

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Logic low, output voltage [6]	I_F = 1.6 mA, I_O = 4.8 mA, V_{CC} = 4.5 V	6N138	V_{OL}		0.1	0.4	V
	I_F = 1.6 mA, I_O = 8.0 mA, V_{CC} = 4.5 V	6N139	V_{OL}		0.1	0.4	V
	I_F = 5.0 mA, I_O = 15 mA, V_{CC} = 4.5 V	6N139	V_{OL}		0.15	0.4	V
	I_F = 12 mA, I_O = 24 mA, V_{CC} = 4.5 V	6N139	V_{OL}		0.25	0.4	V
Logic high, output current[6]	I_F = 0 mA, V_{CC} = V_{CC} = 7.0 V	6N138	I_{OH}		0.1	250	µA
	I_F = 0 mA, V_{CC} = V_{CC} = 18 V	6N139	I_{OH}		0.05	100	µA
Logic low supply current [6]	I_F = 1.6 mA, V_O = OPEN, V_{CC} = 18 V		I_{CCL}		0.2	1.5	mA
Logic high supply current [6]	I_F = 0 mA, V_O = OPEN, V_{CC} = 18 V		I_{CCH}		0.001	10	µA

[6] Pin 7 open

Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Input capacitance	f = 1.0 MHz, V_F = 0	C_{IN}		25		pF
Input output insulation leakage current[7]	45 % relative humidity, T_{amb} = 25 °C, t = 5.0 s, V_{IO} = 3000 VDC				1.0	µA
Resistance (input output) [7]	V_{IO} = 500 VDC	R_{IO}		10^{12}		Ω
Capacitance (input-output) [7]	f = 1.0 MHz	C_{IO}		0.6		pF

[7] Device considered a two-terminal device: pins 1, 2, 3 and 4 shorted together and pins 5, 6, 7, and 8 shorted together.

Current Transfer Ratio

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Current Transfer Ratio[5), 6)]	I_F = 1.6 mA, V_O = 0.4 V, V_{CC} = 4.5 V	6N138	CTR	300	1600		%
Current Transfer Ratio	I_F = 0.5 mA, V_O = 0.4 V, V_{CC} = 4.5 V	6N139	CTR	400	1600		%
	I_F = 1.6 mA, V_O = 0.4 V, V_{CC} = 4.5 V	6N139	CTR	500	2000		%

5) DC current transfer ratio is defined as the ratio of output collector current, I_O, to the forward LED input current, I_F times 100 %.

6) Pin 7 open

Switching Characteristics

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
Propagation delay time to logic low at output	I_F = 1.6 mA, R_L = 2.2 kΩ	6N138	t_{PHL}		2.0	10	µs
Propagation delay time to logic low at output [6), 8)]	I_F = 0.5 mA, R_L = 4.7 kΩ	6N139	t_{PHL}		6.0	25	µs
	I_F = 12 mA, R_L = 270 Ω	6N139	t_{PHL}		0.6	1.0	µs
Propagation delay time to logic high at output	I_F = 1.6 mA, R_L = 2.2 kΩ	6N138	t_{PLH}		2.0	35	µs
	I_F = 0.5 mA, R_L = 4.7 kΩ	6N139	t_{PLH}		4.0	60	µs
Propagation delay time to logic high at output [6), 8)]	I_F = 12 mA, R_L = 270 Ω	6N139	t_{PLH}		1.5	7.0	µs

6) Pin 7 open

8) Using a resistor between pin 5 and 7 will decrease gain and delay time.

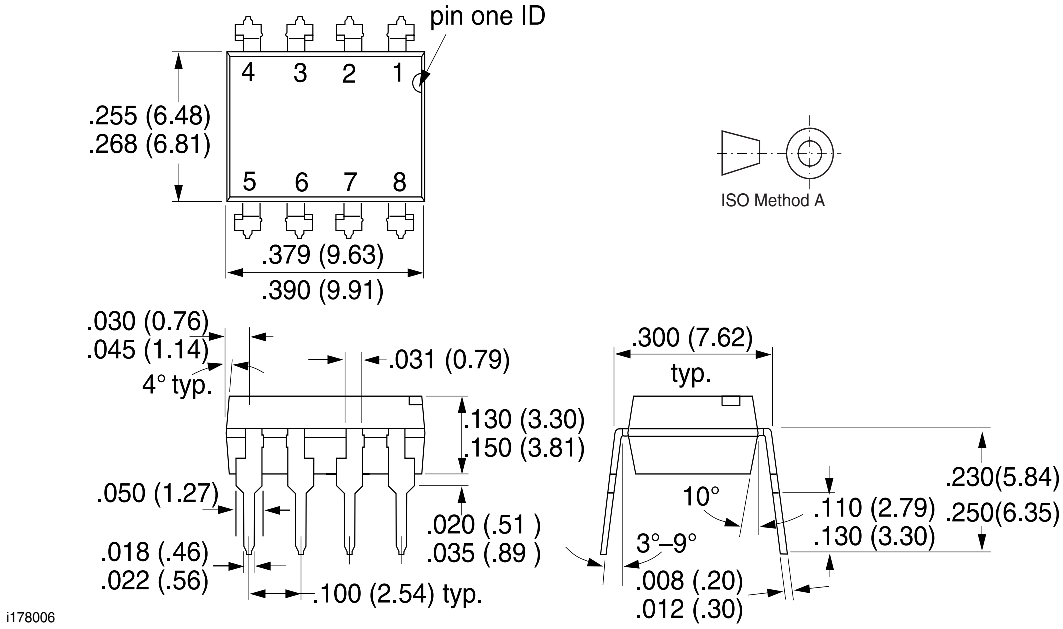
Common Mode Transient Immunity

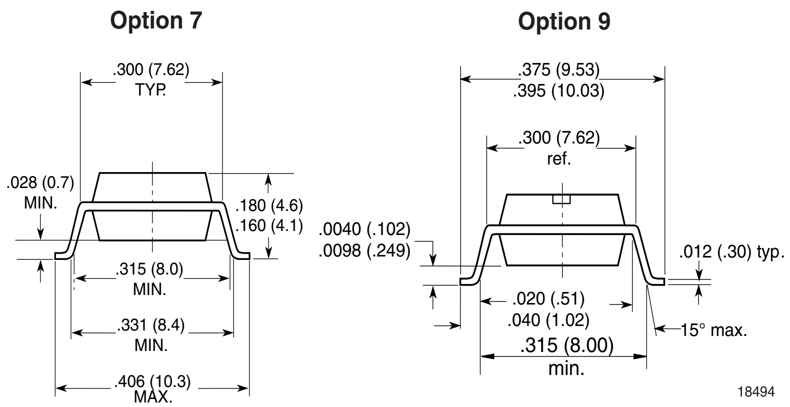
Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Common mode transient immunity, logic high level output [9), 10)]	I_F = 0 mA, R_L = 2.2 kΩ, R_{CC} = 0, $\|V_{CM}\|$ = 10 V_{P-P}	$\| CM_H \|$		500		V/µs
Common mode transient immunity, logic low level output [9), 10)]	I_F = 1.6 mA, R_L = 2.2 kΩ, R_{CC} = 0, $\|V_{CM}\|$ = 10 V_{P-P}	$\| CM_L \|$		- 500		V/µs

9) Common mode transient immunity in logic high level is the maximum tolerable (positive) dVcm/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 > 2.0 V) common mode transient immunity in logic low level is the maximum tolerable (negative) dVcm/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 < 0.8 V).

10) In applications where dv/dt may exceed 50,000 V/µs (such as state discharge) a series resistor, R_{CC} should be included to protect I_C from destructively high surge currents.The recommend value is $R_{CC} \cong [(1\ V)/(0.15\ I_F\ (mA))]$ KΩ

Package Dimensions in Inches (mm)





Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operatingsystems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design and may do so without further notice.
Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

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