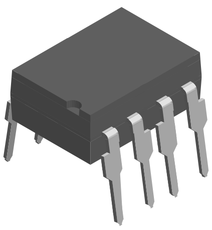
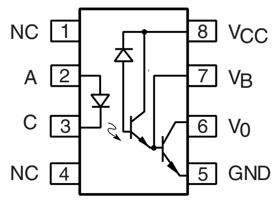
High Speed Optocoupler, 100 kBd, Low Input Current, Photodiode Darlington Output





i179082

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 (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

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.

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

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- DIN EN 60747-5-5 available with option 1

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)

Note
For additional information on the available options refer to option information.

ABSOLUTE MAXIMUM RATINGS [1]					
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**VALUE**	**UNIT**
INPUT					
Reverse voltage			V_R	5.0	V
Forward current			I_F	25	mA
Average input current			$I_{f(avg)}$	20	mA
Input power dissipation [2][4]			P_{diss}	35	mW
OUTPUT					
Supply and output voltage	Pin 8 to 5, pin 6 to 5	6N138	V_{CC}, V_O	- 0.5 to 7.0	V
	Pin 8 to 5, pin 6 to 5	6N139	V_{CC}, V_O	- 0.5 to 18	V
Emitter base reverse voltage	pin 5 to 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 [3][5]			P_{diss}	100	mW
COUPLER					
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 [6]	t = 10 s		T_{sld}	260	°C

Notes

[1] 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 ratings for extended periods of the time can adversely affect reliability.

[2] Derate linearly above 50 °C free-air temperature at a rate of 0.4 mA/°C.

[3] Derate linearly above 50 °C free-air temperature at a rate of 0.7 mW/°C.

[4] Derate linearly above 25 °C free-air temperature at a rate of 0.7 mA/°C.

[5] Derate linearly above 25 °C free-air temperature at a rate of 2.0 mW/°C.

[6] Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTICS [1]							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Input forward voltage	I_F = 1.6 mA		V_F		1.4	1.7	V
Input reverse breakdown voltage	I_R = 10 µA		B_{VR}	5.0			V
Temperature coefficient of forward voltage	I_F = 1.6 mA				- 1.8		mV/°C

ELECTRICAL CHARACTERISTICS (1)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
OUTPUT							
Logic low, output voltage (2)	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 (2)	I_F = 0 mA, V_{CC} = 7.0 V	6N138	I_{OH}		0.1	250	µA
	I_F = 0 mA, V_{CC} = 18 V	6N139	I_{OH}		0.05	100	µA
Logic low supply current (2)	I_F = 1.6 mA, V_O = OPEN, V_{CC} = 18 V		I_{CCL}		0.2	1.5	mA
Logic high supply current (2)	I_F = 0 mA, V_O = OPEN, V_{CC} = 18 V		I_{CCH}		0.001	10	µA
COUPLER							
Input capacitance	f = 1.0 MHz, V_F = 0		C_{IN}		25		pF
Input output insulation leakage current (3)	45 % relative humidity, T_{amb} = 25 °C, t = 5.0 s, V_{IO} = 3000 VDC					1.0	µA
Resistance (input to output) (3)	V_{IO} = 500 VDC		R_{IO}		10^{12}		Ω
Capacitance (input to output) (3)	f = 1.0 MHz		C_{IO}		0.6		pF

Notes

(1) 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.

(2) Pin 7 open.

(3) 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 (1)(2)	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		%

Notes

(1) 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 %.

(2) 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 (1)(2)	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 (1)(2)	I_F = 12 mA, R_L = 270 Ω	6N139	t_{PLH}		1.5	7.0	µs

Notes

(1) Pin 7 open.

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

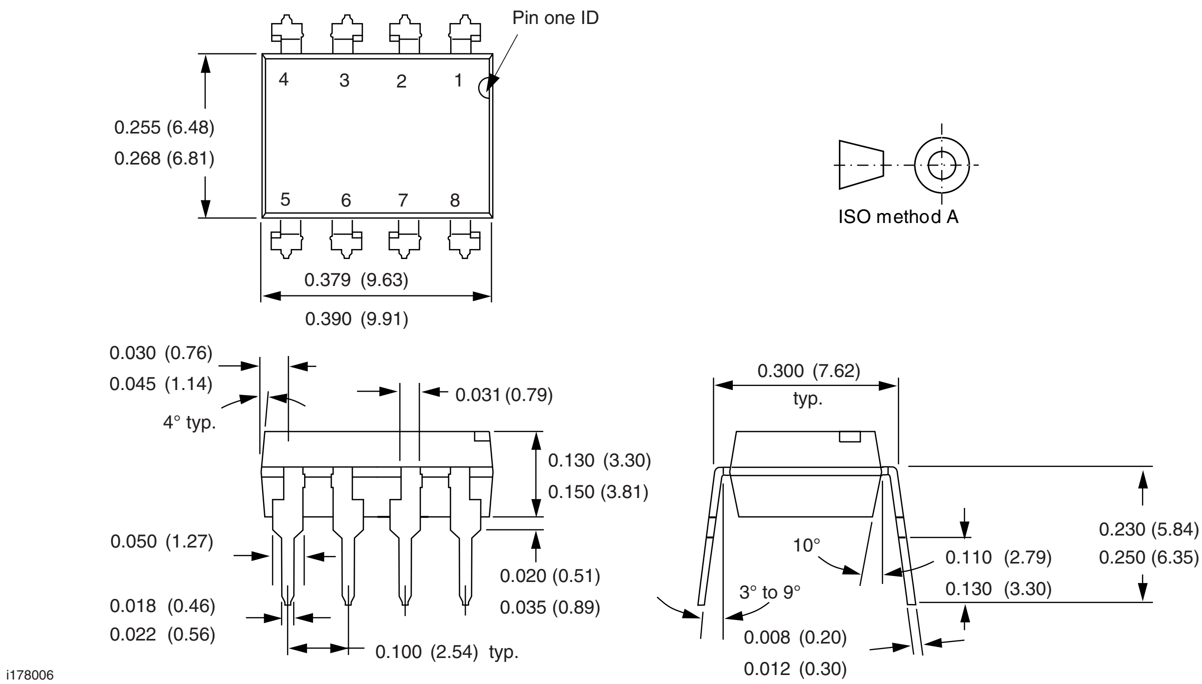
COMMON MODE TRANSIENT IMMUNITY							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Common mode transient immunity, logic high level output (1)(2)	$I_F = 0$ mA, $R_L = 2.2$ kΩ, $R_{CC} = 0$, $\lvert V_{CM}\rvert = 10$ V_{P-P}		$\lvert CM_H\rvert$		500		V/µs
Common mode transient immunity, logic low level output (1)(2)	$I_F = 0$ mA, $R_L = 2.2$ kΩ, $R_{CC} = 0$, $\lvert V_{CM}\rvert = 10$ V_{P-P}		$\lvert CM_L\rvert$		- 500		V/µs

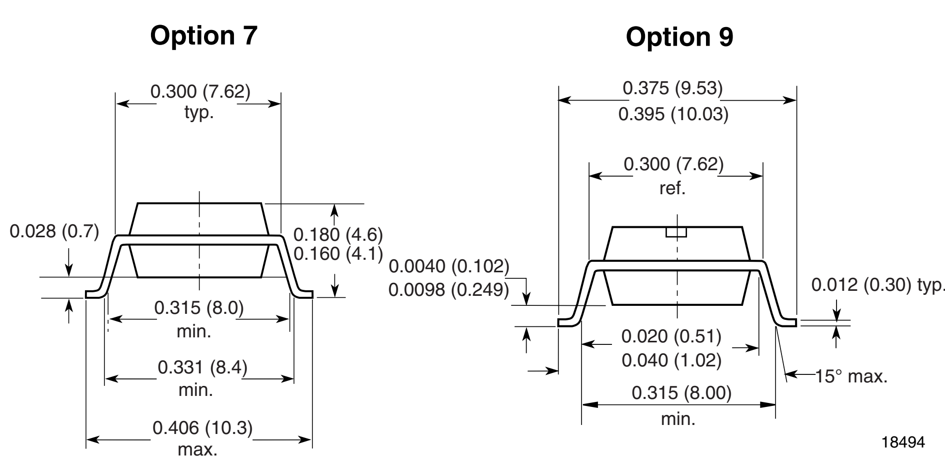
Notes

(1) Common mode transient immunity in logic high level is the maxium 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).

(2) 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 (millimeters)





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

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 operating systems 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.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.