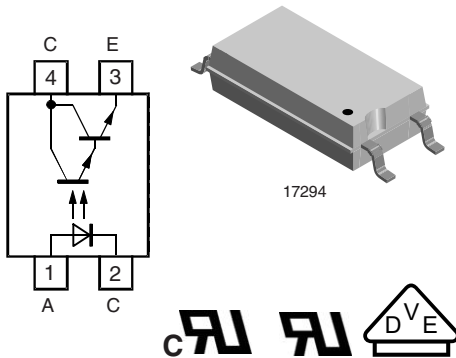


## Optocoupler, Photodarlington Output, SOP-4L, Long Mini-Flat Package



### FEATURES

- Low profile package
- Darlington output
- Extra low coupling capacity - typical 0.2 pF
- High common mode rejection
- Creepage current resistance according to VDE 0303/IEC 60112 comparative tracking index: CTI  $\geq$  175
- Thickness through insulation  $\geq$  0.75 mm
- Creepage distance > 8 mm
- Tested acc. 60950: AM4: 1997 clause 2.9.6.
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC


**RoHS  
COMPLIANT**

### DESCRIPTION

The TCLD1000 consists of a darlington phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-lead SO6L package.

The elements are mounted on one leadframe, provide a fixed distance between input and output for highest safety requirements.

### AGENCY APPROVALS

- UL1577, file no. E76222 system code W, double protection
- CSA 22.2 bulletin 5A, double protection
- BSI IEC 60950 IEC 60065
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending

### APPLICATIONS

- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface
- Reinforced isolation provides circuit protection against electrical shock (safety class II)
- Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):
  - for appl. class I - IV at mains voltage  $\leq$  300 V
  - for appl. class I - III at mains voltage  $\leq$  600 V according to DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending.

### ORDER INFORMATION

PART	REMARKS
TCLD1000	CTR > 600 %, SMD-4

### ABSOLUTE MAXIMUM RATINGS (1)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	6	V
Forward current		$I_F$	60	mA
Forward surge current	$t_p \leq 10 \mu s$	$I_{FSM}$	1.5	A
Power dissipation		$P_{diss}$	100	mW
Junction temperature		$T_j$	125	$^{\circ}C$
<b>OUTPUT</b>				
Collector emitter voltage		$V_{CEO}$	35	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	80	mA
Collector peak current	$t_p/T = 0.5, t_p \leq 10 ms$	$I_{CM}$	100	mA
Power dissipation		$P_{diss}$	150	mW
Junction temperature		$T_j$	125	$^{\circ}C$

ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>COUPLER</b>				
Isolation test voltage (RMS)		$V_{ISO}$	5000	$V_{RMS}$
Total power dissipation		$P_{tot}$	250	mW
Operating ambient temperature range		$T_{amb}$	- 40 to + 100	°C
Storage temperature range		$T_{stg}$	- 40 to + 125	°C
Soldering temperature <sup>(2)</sup>		$T_{sld}$	260	°C

**Note**

<sup>(1)</sup>  $T_{amb} = 25\text{ °C}$ , 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.

<sup>(2)</sup> Refer to reflow profile for soldering conditions for surface mounted devices.

ELECTRICAL CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	$I_F = 20\text{ mA}$	$V_F$		1.1	1.4	V
Junction capacitance	$V_R = 0\text{ V}$ , $f = 1\text{ MHz}$	$C_j$		50		pF
<b>OUTPUT</b>						
Collector emitter voltage	$I_C = 1\text{ mA}$	$V_{CEO}$	32			V
Emitter collector voltage	$I_E = 100\text{ }\mu\text{A}$	$V_{ECO}$	7			V
Collector emitter cut-off current	$V_{CE} = 10\text{ V}$ , $I_F = 0\text{ A}$ , $E = 0$	$I_{CEO}$		15	100	nA
<b>COUPLER</b>						
Collector emitter saturation voltage	$I_F = 20\text{ mA}$ , $I_C = 5\text{ mA}$	$V_{CEsat}$			1.0	V
Cut-off frequency	$V_{CE} = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 100\text{ }\Omega$	$f_c$		10		kHz
Coupling capacitance	$f = 1\text{ MHz}$	$C_k$		0.3		pF

**Note**

$T_{amb} = 25\text{ °C}$ , unless otherwise specified.

Minimum and maximum values are tested requirements. Typical values are characteristics of the device and are the result of engineering evaluations. Typical values are for information only and are not part of the testing requirements.

CURRENT TRANSFER RATIO						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$V_{CE} = 2\text{ V}$ , $I_F = 1\text{ mA}$	CTR	600	800		%

MAXIMUM SAFETY RATINGS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward current		$I_F$			130	mA
<b>OUTPUT</b>						
Power dissipation	$T_{amb} \leq 25\text{ °C}$	$P_{diss}$			265	mW
<b>COUPLER</b>						
Rated impulse voltage		$V_{IOTM}$			8	kV
Safety temperature		$T_{si}$			150	°C

**Note**

According to DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending (see figure 1). This optocoupler is suitable for safe electrical isolation only within the safety ratings. Compliance with the safety ratings shall be ensured by means of suitable protective circuits.

INSULATION RATED PARAMETERS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Partial discharge test voltage - routine test	100 %, $t_{test} = 1$ s	$V_{pd}$	2.0			kV
Partial discharge test voltage - lot test (sample test)	$t_{Tr} = 60$ s, $t_{test} = 10$ s, (see figure 2)	$V_{IOTM}$	8			kV
		$V_{pd}$	1.68			kV
Insulation resistance	$V_{IO} = 500$ V	$R_{IO}$	$10^{12}$			$\Omega$
	$V_{IO} = 500$ V, $T_{amb} = 100$ °C	$R_{IO}$	$10^{11}$			$\Omega$
	$V_{IO} = 500$ V, $T_{amb} = 150$ °C (construction test only)	$R_{IO}$	$10^9$			$\Omega$

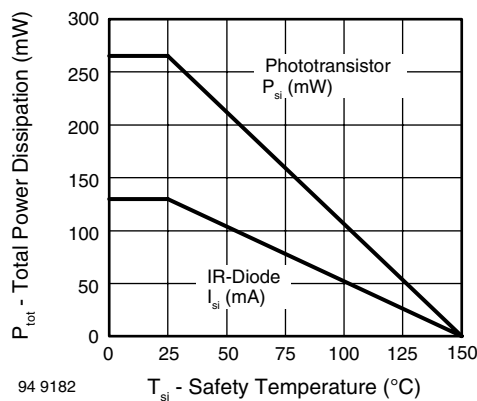


Fig. 1 - Derating Diagram

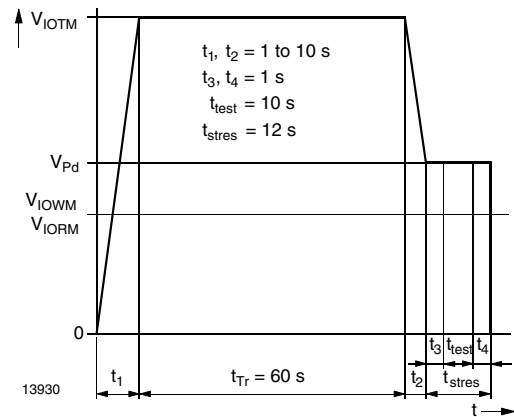


Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-; IEC 60747

SWITCHING CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Rise time	$V_{CE} = 2$ V, $I_C = 10$ mA, $R_L = 100$ $\Omega$ , (see figure 3)	$t_r$		300		$\mu$ s
Turn-off time	$V_{CE} = 2$ V, $I_C = 10$ mA, $R_L = 100$ $\Omega$ , (see figure 3)	$t_{off}$		250		$\mu$ s

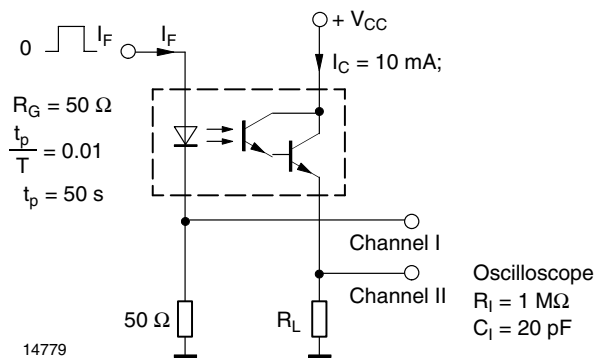


Fig. 3 - Test Circuit, Non-Saturated Operation

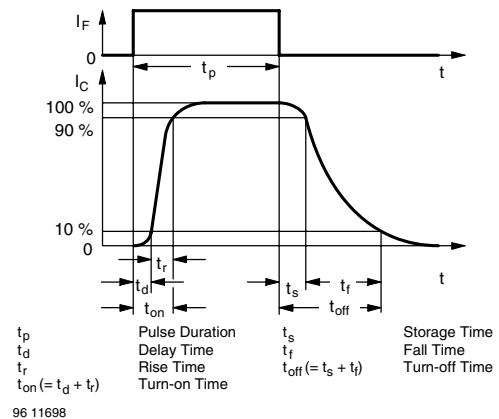


Fig. 4 - Switching Times

**TYPICAL CHARACTERISTICS**

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

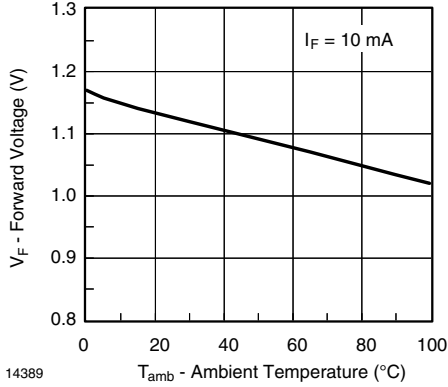


Fig. 5 - Forward Voltage vs. Ambient Temperature

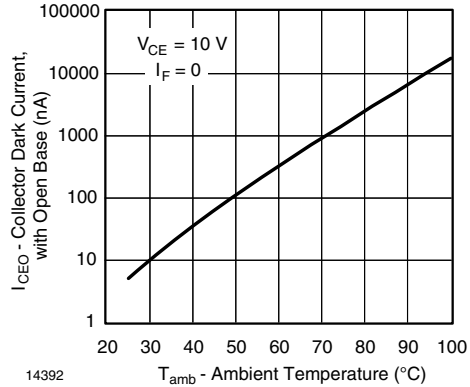


Fig. 8 - Collector Dark Current vs. Ambient Temperature

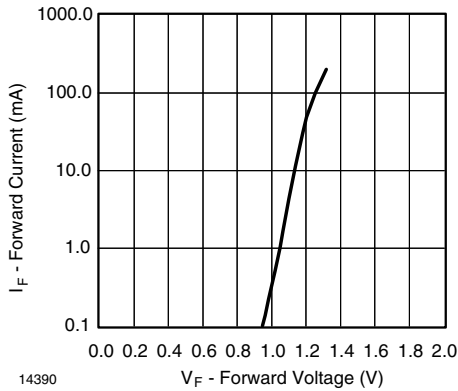


Fig. 6 - Forward Current vs. Forward Voltage

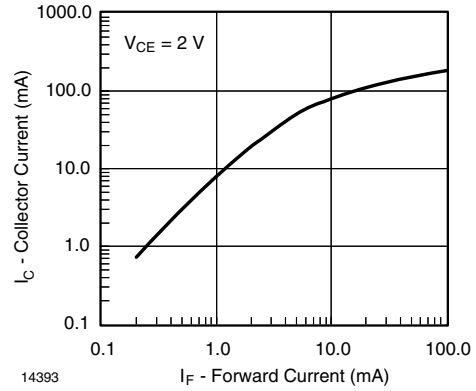


Fig. 9 - Collector Current vs. Forward Current

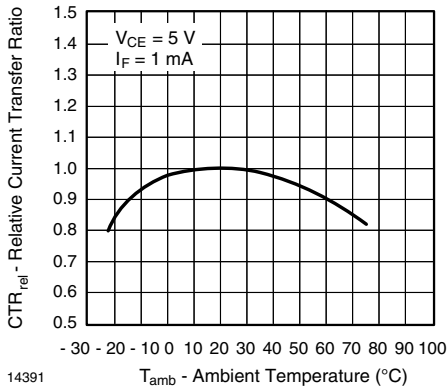


Fig. 7 - Relative Current Transfer Ratio vs. Ambient Temperature

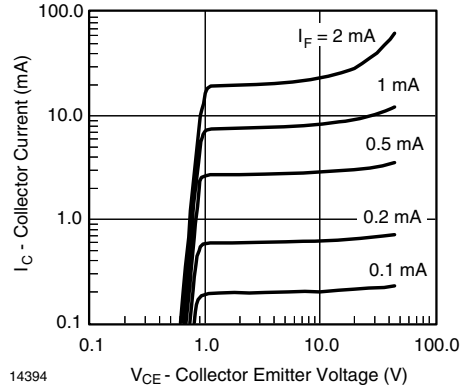


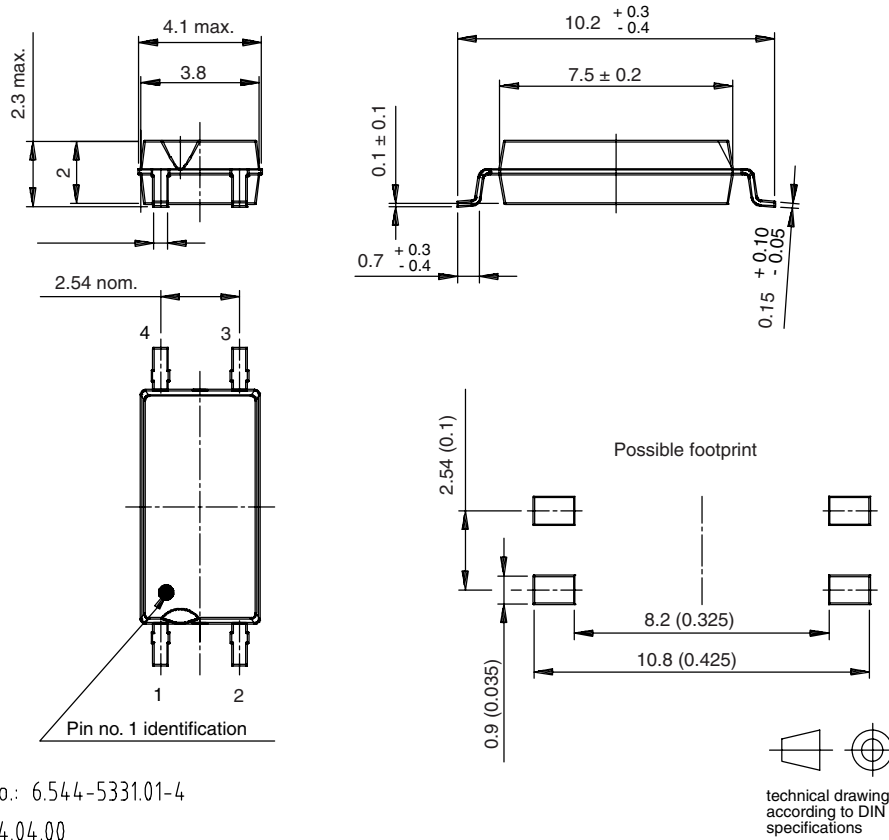
Fig. 10 - Collector Current vs. Collector Emitter Voltage



Optocoupler, Photodarlington Output,  
SOP-4L,  
Long Mini-Flat Package

Vishay Semiconductors

**PACKAGE DIMENSIONS** in millimeters



Drawing-No.: 6.544-5331.01-4  
Issue: 1; 04.04.00  
15243

Vishay Semiconductors    Optocoupler, Photodarlington Output,  
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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.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

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