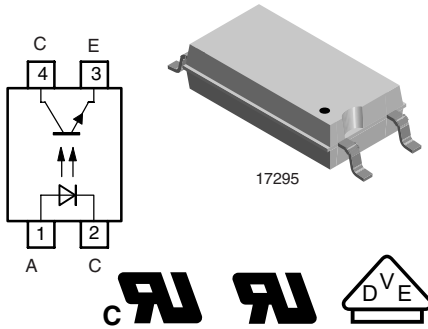


## Optocoupler, Phototransistor Output, SOP-4L, Long Mini-Flat Package



### DESCRIPTION

The TCLT10.. series consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4 lead SOP4L package.

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

### FEATURES

- SMD low profile 4 lead package
- $V_{IORM} = 1050\text{ V}$
- CTR flexibility available see order information
- Special construction
- Extra low coupling capacitance
- DC input with transistor output
- Creepage distance > 8 mm
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



**RoHS**  
COMPLIANT

### APPLICATIONS

- Switchmode power supplies
- Computer peripheral interface
- Microprocessor system interface

### AGENCY APPROVALS

- UL1577, file no. E76222 system code W, double protection
- CSA (C-UL) 22.2 bulletin 5A recognized file no. E-76222
- BSI: BS EN 41003, BS EN 60065 (BS 415), BS EN 60950 (BS 7002), certificate number 7081 and 7402
- DIN EN 60747-5-2 (VDE 0884)  
DIN EN 60747-5-5 pending
- FIMKO (SETI): EN 60950, certificate no. 11027

Note:

See the safety standard approval list "Agency Table" for more detailed information.

<b>ORDER INFORMATION</b>	
PART	REMARKS
TCLT1000	CTR 50 to 600 %, SOP-4L
TCLT1002	CTR 63 to 125 %, SOP-4L
TCLT1003	CTR 100 to 200 %, SOP-4L
TCLT1004	CTR 160 to 320 %, SOP-4L
TCLT1005	CTR 50 to 150 %, SOP-4L
TCLT1006	CTR 100 to 300 %, SOP-4L
TCLT1007	CTR 80 to 160 %, SOP-4L
TCLT1008	CTR 130 to 260 %, SOP-4L
TCLT1009	CTR 200 to 400 %, SOP-4L

### Note

Available only on tape and reel.

ABSOLUTE MAXIMUM RATINGS				
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	°C
<b>OUTPUT</b>				
Collector emitter voltage		$V_{CEO}$	70	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	50	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	°C
<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 + 100	°C
Soldering temperature		$T_{sld}$	260	°C

**Note**

$T_{amb} = 25 \text{ }^\circ\text{C}$ , 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.

ELECTRICAL CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward voltage	$I_F = 50 \text{ mA}$	$V_F$		1.25	1.6	V
Junction capacitance	$V_R = 0 \text{ V}, f = 1 \text{ MHz}$	$C_j$		50		pF
<b>OUTPUT</b>						
Collector emitter voltage	$I_C = 1 \text{ mA}$	$V_{CEO}$	70			V
Emitter collector voltage	$I_E = 100 \mu\text{A}$	$V_{ECO}$	7			V
Collector emitter cut-off current	$V_{CE} = 20 \text{ V}, I_F = 0, E = 0$	$I_{CEO}$		10	100	nA
<b>COUPLER</b>						
Collector emitter saturation voltage	$I_F = 10 \text{ mA}, I_C = 1 \text{ mA}$	$V_{CEsat}$			0.3	V
Cut-off frequency	$V_{CE} = 5 \text{ V}, I_F = 10 \text{ mA}, R_L = 100 \Omega$	$f_c$		110		kHz
Coupling capacitance	$f = 1 \text{ MHz}$	$C_k$		0.3		pF

**Note**

$T_{amb} = 25 \text{ }^\circ\text{C}$ , 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.



<b>CURRENT TRANSFER RATIO</b>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
I <sub>C</sub> /I <sub>F</sub>	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 5 mA	TCLT1000	CTR	50		600	%
	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 10 mA	TCLT1002	CTR	63		125	%
		TCLT1003	CTR	100		200	%
	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 1 mA	TCLT1002	CTR	22	45		%
		TCLT1003	CTR	34	70		%
		TCLT1004	CTR	56	100		%
	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 5 mA	TCLT1005	CTR	50		150	%
		TCLT1006	CTR	100		300	%
		TCLT1007	CTR	80		160	%
		TCLT1008	CTR	130		260	%
TCLT1009		CTR	200		400	%	

<b>MAXIMUM SAFETY RATINGS</b>						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward current		I <sub>F</sub>			130	mA
<b>OUTPUT</b>						
Power dissipation		P <sub>diss</sub>			265	mW
<b>COUPLER</b>						
Rated impulse voltage		V <sub>IOTM</sub>			8	kV
Safety temperature		T <sub>si</sub>			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.

<b>INSULATION RATED PARAMETERS</b>						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Partial discharge test voltage - routine test	100 %, t <sub>test</sub> = 1 s	V <sub>pd</sub>	2			kV
Partial discharge test voltage - lot test (sample test)	t <sub>tr</sub> = 60 s, t <sub>test</sub> = 10 s, (see figure 2)	V <sub>IOTM</sub>	8			kV
		V <sub>pd</sub>	1.68			kV
Insulation resistance	V <sub>IO</sub> = 500 V	R <sub>IO</sub>	10 <sup>12</sup>			Ω
	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 100 °C	R <sub>IO</sub>	10 <sup>11</sup>			Ω
	V <sub>IO</sub> = 500 V, T <sub>amb</sub> = 150 °C (construction test only)	R <sub>IO</sub>	10 <sup>9</sup>			Ω

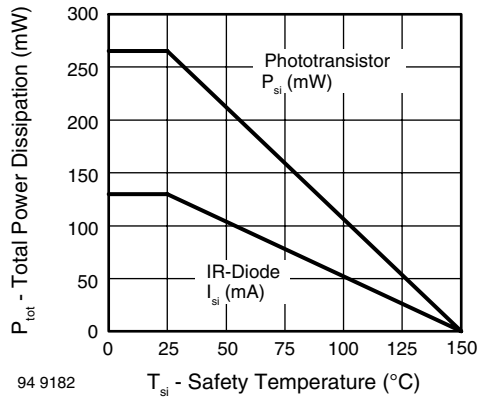


Fig. 1 - Derating Diagram

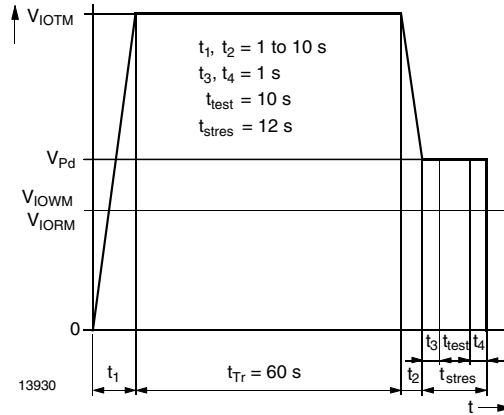


Fig. 2 - Test Pulse Diagram for Sample Test according to  
DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-; IEC60747

SWITCHING CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Delay time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)	$t_d$		3		$\mu\text{s}$
Rise time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)	$t_r$		3		$\mu\text{s}$
Fall time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)	$t_f$		4.7		$\mu\text{s}$
Storage time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)	$t_s$		0.3		$\mu\text{s}$
Turn-on time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)	$t_{on}$		6		$\mu\text{s}$
Turn-off time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ , (see figure 3)	$t_{off}$		5		$\mu\text{s}$
Turn-on time	$V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ , (see figure 4)	$t_{on}$		9		$\mu\text{s}$
Turn-off time	$V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ , (see figure 4)	$t_{off}$		10		$\mu\text{s}$

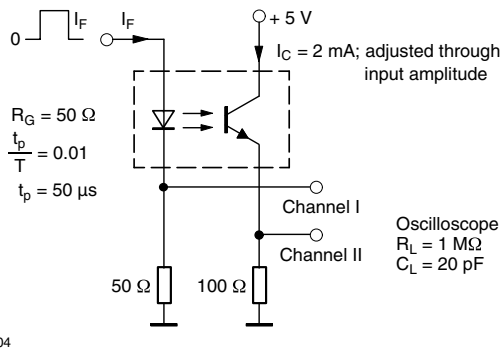


Fig. 3 - Test Circuit, Non-Saturated Operation

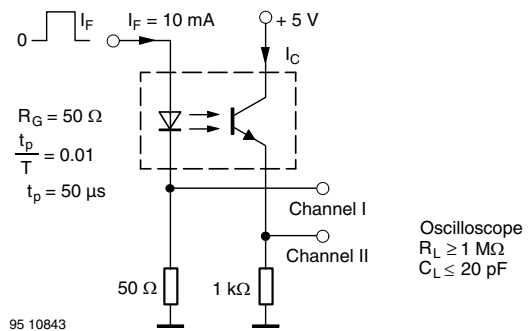


Fig. 4 - Test Circuit, Saturated Operation

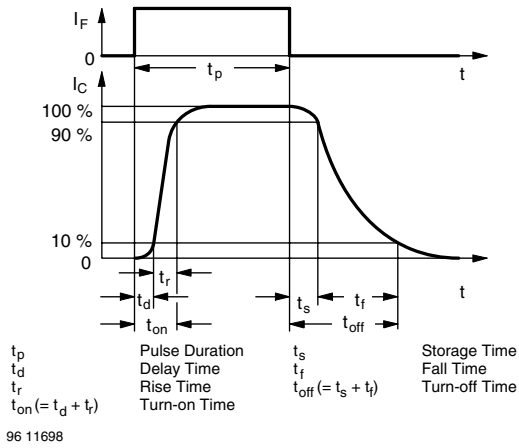


Fig. 5 - Switching Times

**TYPICAL CHARACTERISTICS**

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

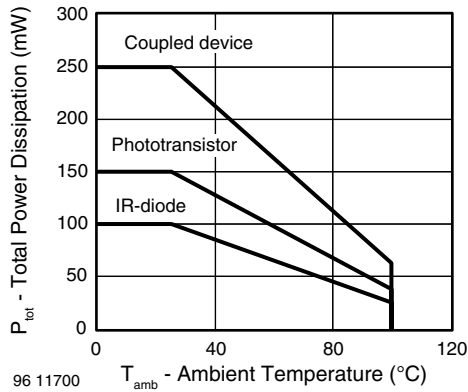


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

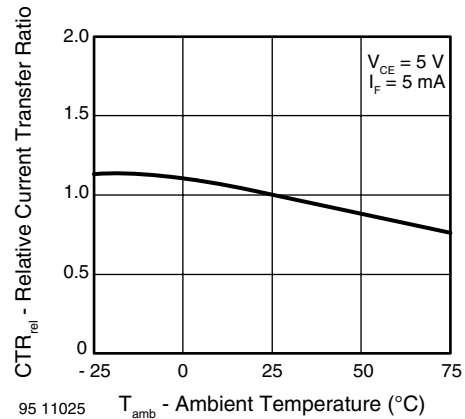


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

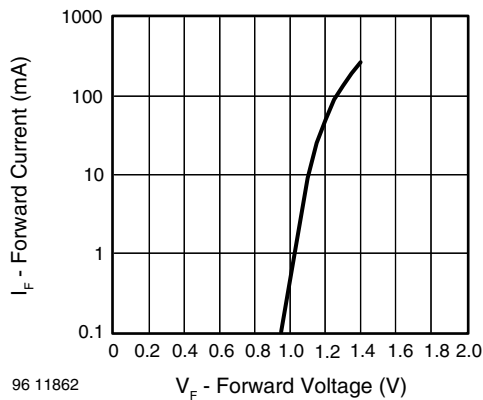


Fig. 7 - Forward Current vs. Forward Voltage

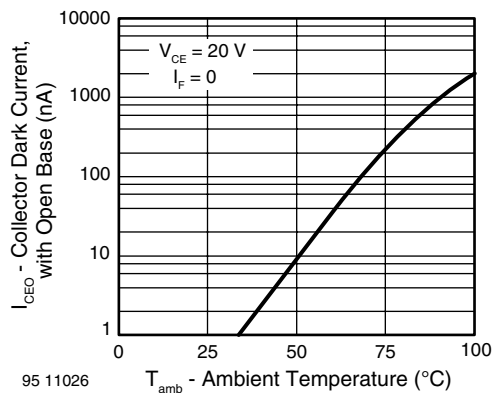
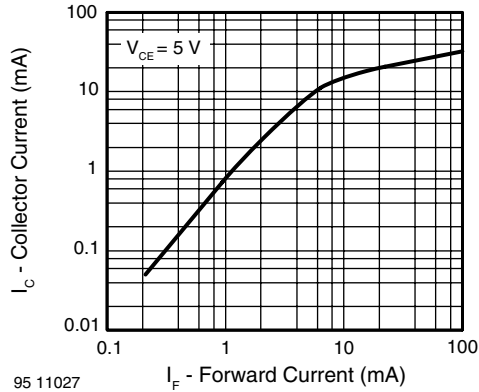
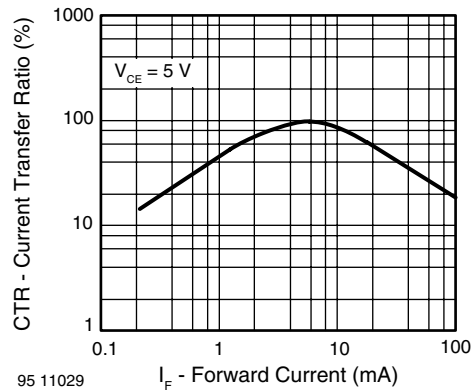


Fig. 9 - Collector Dark Current vs. Ambient Temperature



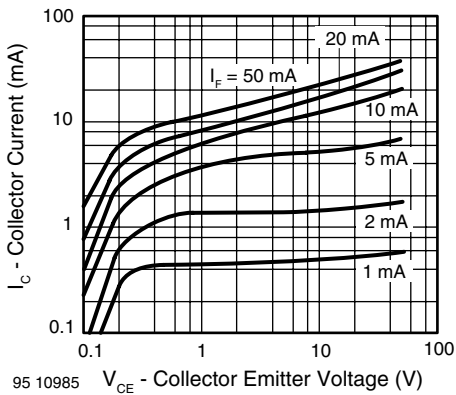
95 11027

Fig. 10 - Collector Current vs. Forward Current



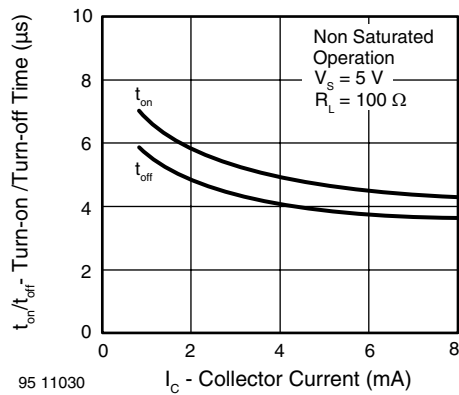
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Fig. 13 - Current Transfer Ratio vs. Forward Current



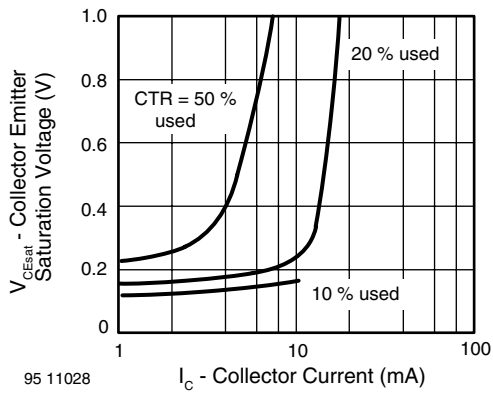
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Fig. 11 - Collector Current vs. Collector Emitter Voltage



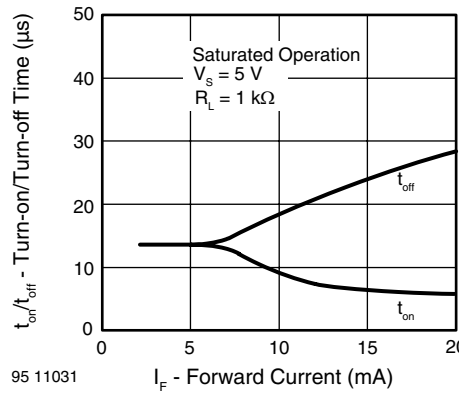
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Fig. 14 - Turn-on/off Time vs. Collector Current



95 11028

Fig. 12 - Collector Emitter Saturation Voltage vs. Collector Current

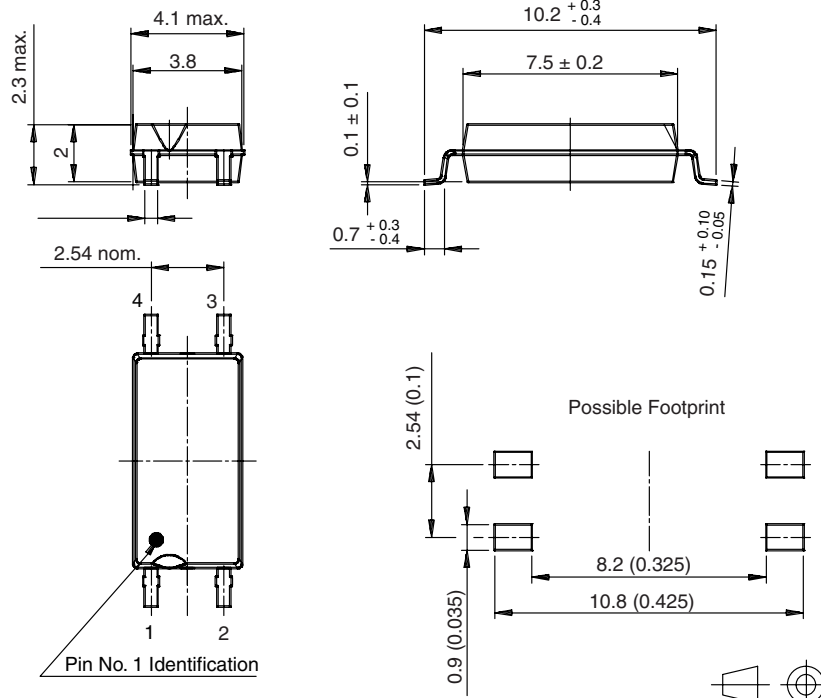


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Fig. 15 - Turn-on/off Time vs. Forward Current



**PACKAGE DIMENSIONS** in millimeters



Drawing-No.: 6.544-5331.01-4

Issue: 1; 04.04.00

15243

## **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.

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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