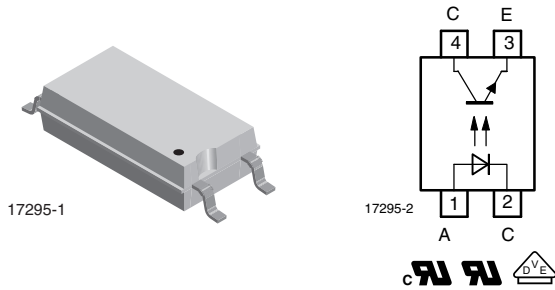


## Optocoupler, Phototransistor Output, SOP-4L, Long Mini-Flat Package



### 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
- Compliant to RoHS Directive 2002/95/EC and in accordance to 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)
- FIMKO (SETI): EN 60950

### Note

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

<b>ORDERING INFORMATION</b>									
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 5px; margin: 2px;">T</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">C</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">L</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">T</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">1</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">0</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">0</div> <div style="border: 1px solid black; padding: 5px; margin: 2px;">#</div> </div> <p style="text-align: center; margin-top: 5px;">PART NUMBER</p>									
AGENCY CERTIFIED/PACKAGE	CTR (%)								
	5 mA	10 mA			5 mA				
<b>UL, cUL, VDE, BSI, FIMKO</b>	50 to 600	63 to 125	100 to 200	160 to 320	50 to 150	100 to 300	80 to 160	130 to 260	200 to 400
SOP-4L	TCLT1000	TCLT1002	TCLT1003	TCLT1004	TCLT1005	TCLT1006	TCLT1007	TCLT1008	TCLT1009

### Note

- Available only on tape and reel.

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		$V_R$	6	V
Forward current		$I_F$	60	mA
Forward surge current	$t_p \leq 10\text{ }\mu\text{s}$	$I_{FSM}$	1.5	A
Power dissipation		$P_{diss}$	100	mW
Junction temperature		$T_j$	125	$^{\circ}\text{C}$
<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	$t_p/T = 0.5, t_p \leq 10\text{ ms}$	$I_{CM}$	100	mA
Power dissipation		$P_{diss}$	150	mW
Junction temperature		$T_j$	125	$^{\circ}\text{C}$
<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	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	- 40 to + 100	$^{\circ}\text{C}$
Soldering temperature		$T_{slid}$	260	$^{\circ}\text{C}$

#### Note

- 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.

<b>ELECTRICAL CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
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	$I_E = 100\text{ }\mu\text{A}$	$V_{ECO}$	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	$V_{CE} = 5\text{ V}, I_F = 10\text{ mA}, R_L = 100\text{ }\Omega$	$f_c$		110		kHz
Coupling capacitance	$f = 1\text{ MHz}$	$C_k$		0.3		pF

#### Note

- 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.



CURRENT TRANSFER RATIO							
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	%
		TCLT1002	CTR	63		125	%
	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 10 mA	TCLT1003	CTR	100		200	%
		TCLT1004	CTR	160		320	%
	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	%

MAXIMUM SAFETY RATINGS						
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 (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 <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

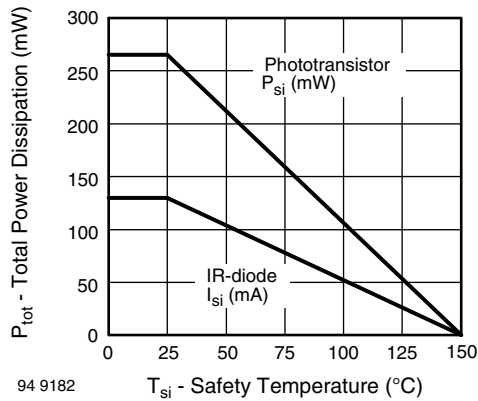


Fig. 1 - Derating Diagram

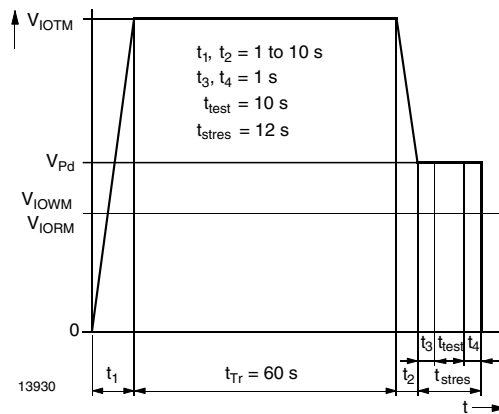


Fig. 2 - Test Pulse Diagram for Sample Test according to  
DIN EN 60747-5-2 (VDE 0884); IEC60747-5-5

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		$\mu\text{s}$

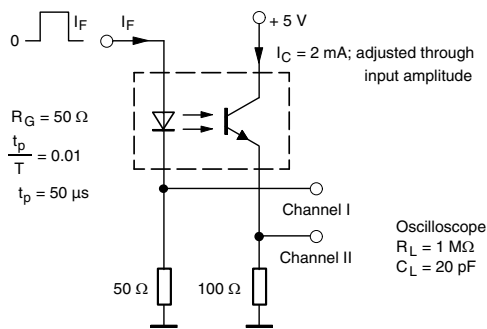


Fig. 3 - Test Circuit, Non-Saturated Operation

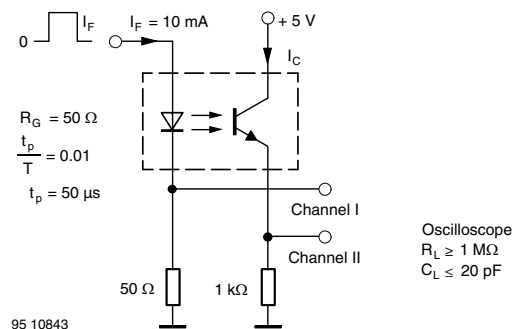


Fig. 4 - Test Circuit, Saturated Operation

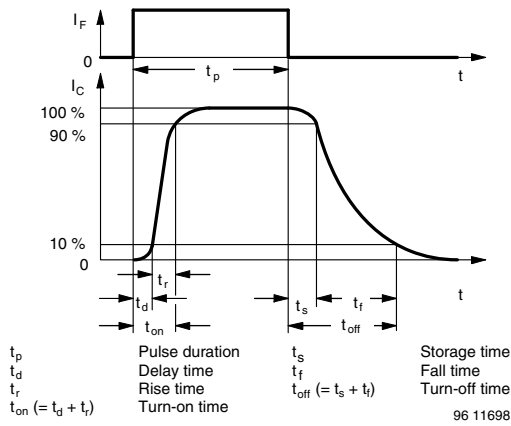


Fig. 5 - Switching Times

### TYPICAL CHARACTERISTICS ( $T_{amb} = 25\text{ }^\circ\text{C}$ , unless otherwise specified)

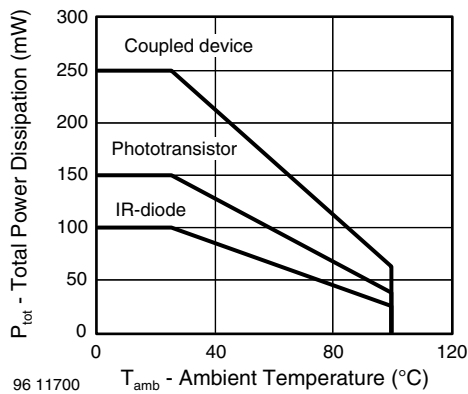


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

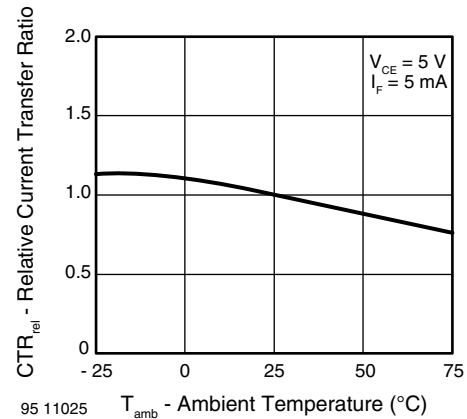


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

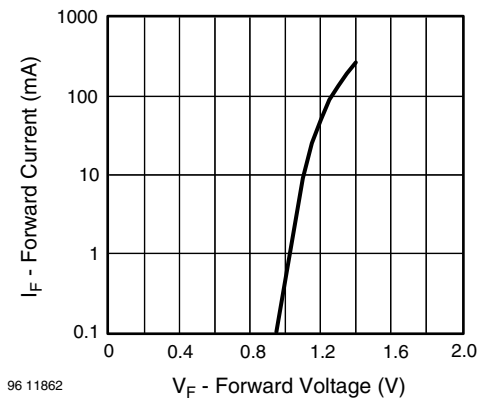


Fig. 7 - Forward Current vs. Forward Voltage

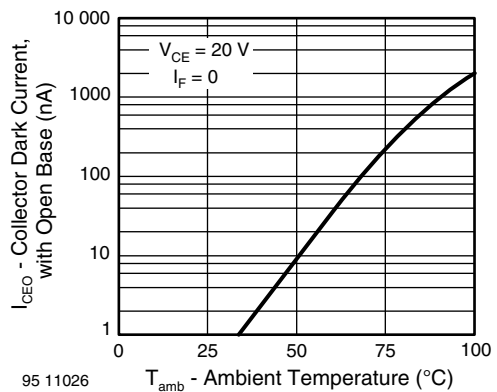
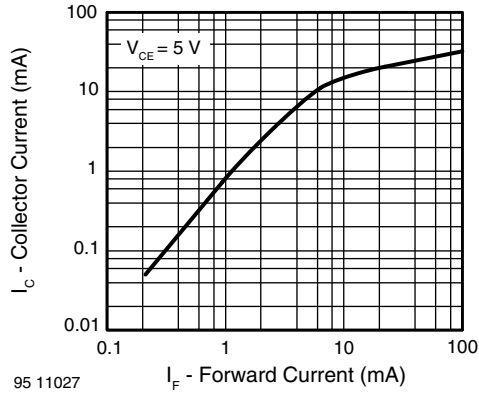
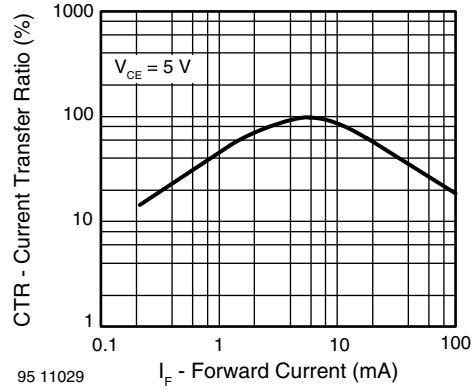


Fig. 9 - Collector Dark Current vs. Ambient Temperature



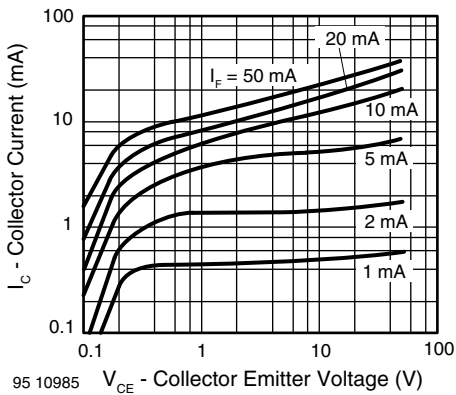
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Fig. 10 - Collector Current vs. Forward Current



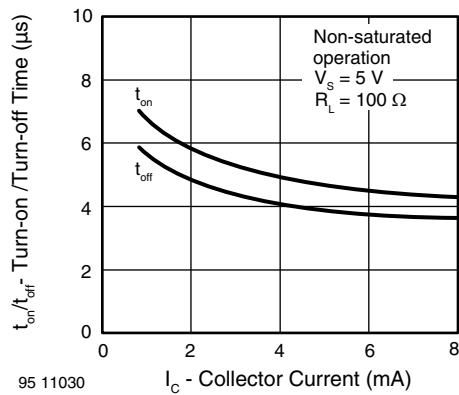
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Fig. 13 - Current Transfer Ratio vs. Forward Current



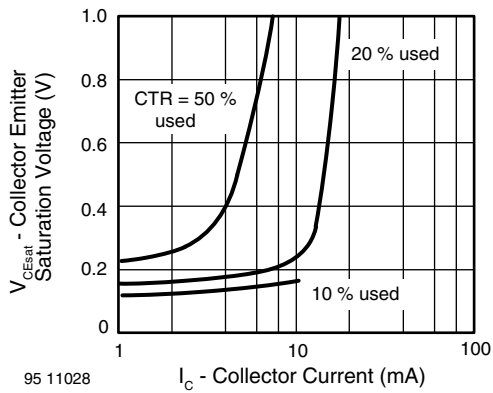
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Fig. 11 - Collector Current vs. Collector Emitter Voltage



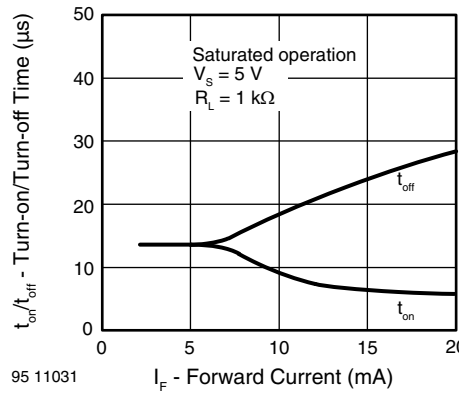
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Fig. 14 - Turn-on/off Time vs. Collector Current



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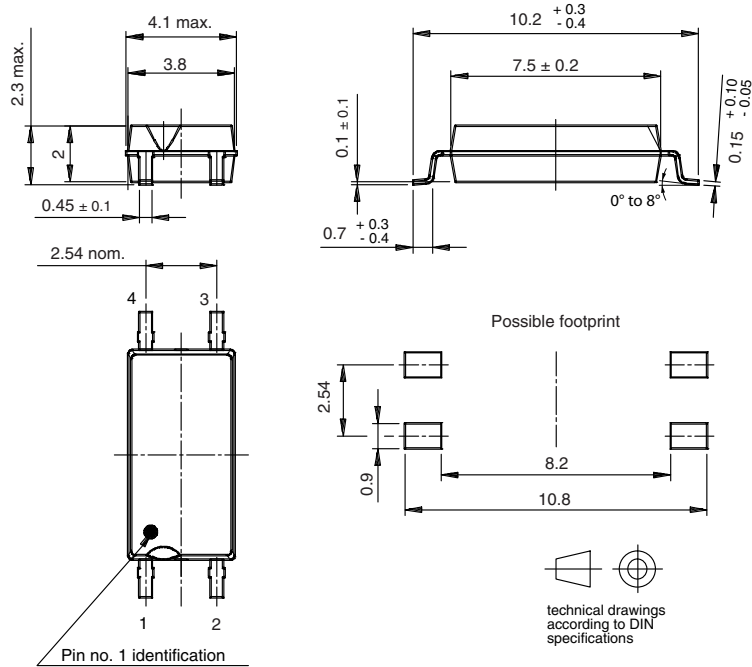
Fig. 12 - Collector Emitter Saturation Voltage vs. Collector Current



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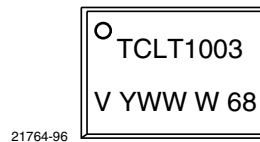
Fig. 15 - Turn-on/off Time vs. Forward Current

### PACKAGE DIMENSIONS in millimeters



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

### PACKAGE MARKING





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