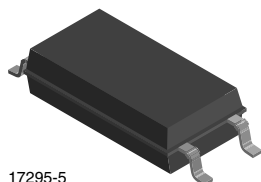
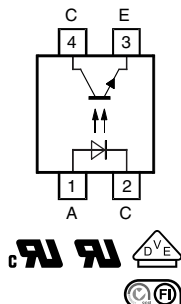




## Optocoupler, Phototransistor Output, SOP-6L4, 110 °C Rated, Long Mini-Flat Package



17295-5



### FEATURES

- SMD low profile 4 lead package
- High isolation 5000 V<sub>RMS</sub>
- CTR flexibility available see order information
- Special construction
- Extra low coupling capacitance
- Connected base
- DC input with transistor output
- Temperature range -55 °C to +110 °C
- Creepage distance > 8 mm
- Material categorization: For definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



### DESCRIPTION

The TCLT101. series consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-lead SOP-6L package.

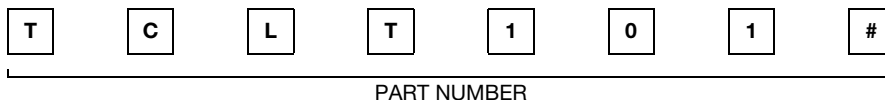
### APPLICATIONS

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

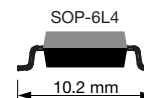
### AGENCY APPROVALS

- UL1577, file no. E76222
- cUL - file no. E76222, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5, available with option 1
- FIMKO: EN 60950

### ORDERING INFORMATION



PART NUMBER



AGENCY CERTIFIED/PACKAGE	CTR (%)								
	5 mA	10 mA			5 mA				
UL, cUL, VDE, FIMKO	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-6L4	TCLT1010	TCLT1012	TCLT1013	TCLT1014	TCLT1015	TCLT1016	TCLT1017	TCLT1018	TCLT1019

### ABSOLUTE MAXIMUM RATINGS (T<sub>amb</sub> = 25 °C, unless otherwise specified)

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
<b>INPUT</b>				
Reverse voltage		V <sub>R</sub>	6	V
Forward current		I <sub>F</sub>	60	mA
Forward surge current	t <sub>p</sub> ≤ 10 μs	I <sub>FSM</sub>	1.5	A
Power dissipation		P <sub>diss</sub>	100	mW
Junction temperature		T <sub>j</sub>	125	°C
<b>OUTPUT</b>				
Collector emitter voltage		V <sub>CEO</sub>	70	V
Emitter collector voltage		V <sub>ECO</sub>	7	V
Collector current		I <sub>C</sub>	50	mA
Collector peak current	t <sub>p</sub> /T = 0.5, t <sub>p</sub> ≤ 10 ms	I <sub>CM</sub>	100	mA
Power dissipation		P <sub>diss</sub>	150	mW
Junction temperature		T <sub>j</sub>	125	°C
<b>COUPLER</b>				
Isolation test voltage (RMS)		V <sub>ISO</sub>	5000	V <sub>RMS</sub>



<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Total power dissipation		$P_{tot}$	250	mW
Operating ambient temperature range		$T_{amb}$	-55 to +110	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	-55 to +125	$^{\circ}\text{C}$
Soldering temperature <sup>(1)</sup>		$T_{sld}$	260	$^{\circ}\text{C}$

**Notes**

- 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>(1)</sup> Wave soldering three cycles are allowed. Also refer to "Assembly Instruction" ([www.vishay.com/doc?80054](http://www.vishay.com/doc?80054)).

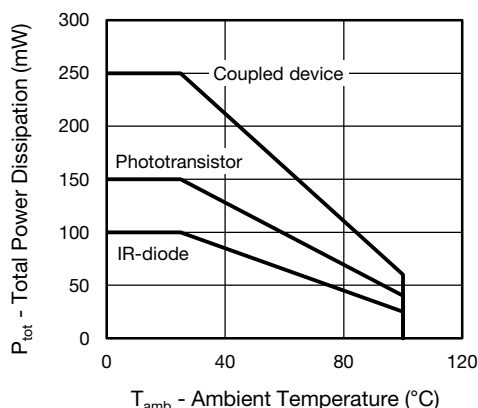


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

<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 leakage current	$V_{CE} = 20\text{ V}$ , $I_F = 0\text{ A}$	$I_{CEO}$		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 ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$V_{CE} = 5\text{ V}$ , $I_F = 5\text{ mA}$	TCLT1010	CTR	50		600	%
		TCLT1012	CTR	63		125	%
	$V_{CE} = 5\text{ V}$ , $I_F = 10\text{ mA}$	TCLT1013	CTR	100		200	%
		TCLT1014	CTR	160		320	%
	$V_{CE} = 5\text{ V}$ , $I_F = 1\text{ mA}$	TCLT1012	CTR	22	45		%
		TCLT1013	CTR	34	70		%
		TCLT1014	CTR	56	100		%
	$V_{CE} = 5\text{ V}$ , $I_F = 5\text{ mA}$	TCLT1015	CTR	50		150	%
		TCLT1016	CTR	100		300	%
		TCLT1017	CTR	80		160	%
TCLT1018		CTR	130		260	%	
TCLT1019		CTR	200		400	%	

SAFETY AND INSULATION RATED PARAMETERS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Partial discharge test voltage - routine test	100 %, $t_{test} = 1\text{ s}$	$V_{pd}$	1.6			kV
Partial discharge test voltage - lot test (sample test)	$t_{Tr} = 60\text{ s}$ , $t_{test} = 10\text{ s}$ , (see figure 2)	$V_{IOTM}$	8			kV
		$V_{pd}$	1.3			kV
Insulation resistance	$V_{IO} = 500\text{ V}$	$R_{IO}$	$10^{12}$			$\Omega$
	$V_{IO} = 500\text{ V}$ , $T_{amb} = 100\text{ }^{\circ}\text{C}$	$R_{IO}$	$10^{11}$			$\Omega$
	$V_{IO} = 500\text{ V}$ , $T_{amb} = 150\text{ }^{\circ}\text{C}$ (construction test only)	$R_{IO}$	$10^9$			$\Omega$
Forward current		$I_{si}$	130			mA
Power dissipation		$P_{so}$	265			mW
Rated impulse voltage		$V_{IOTM}$	8			kV
Safety temperature		$T_{si}$	150			$^{\circ}\text{C}$
Clearance distance			8.0			mm
Creepage distance			8.0			mm
Insulation distance (internal)			0.40			mm

Note

- According to DIN EN 60747-5-2 (VDE 0884) (see figure 2). 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.

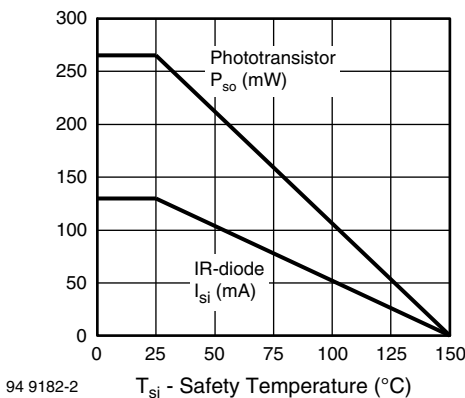


Fig. 2 - Derating Diagram

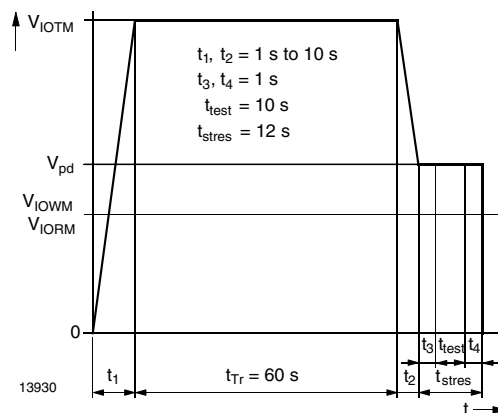


Fig. 3 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884); IEC 60747-5-5

<b>SWITCHING CHARACTERISTICS</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Delay time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 3)	$t_d$		3		$\mu\text{s}$
Rise time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 3)	$t_r$		3		$\mu\text{s}$
Fall time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 3)	$t_f$		4.7		$\mu\text{s}$
Storage time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 3)	$t_s$		0.3		$\mu\text{s}$
Turn-on time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (see figure 3)	$t_{on}$		6		$\mu\text{s}$
Turn-off time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\text{ }\Omega$ , (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		$\mu\text{s}$

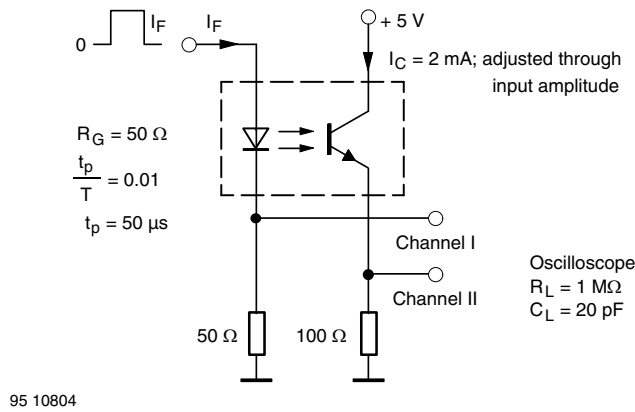


Fig. 4 - Test Circuit, Non-Saturated Operation

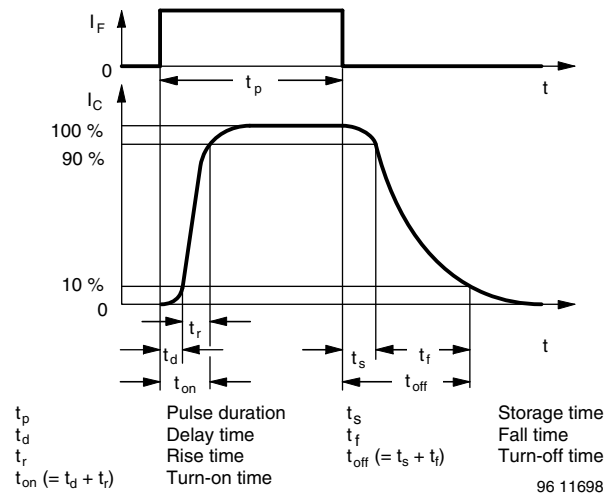


Fig. 6 - Switching Times

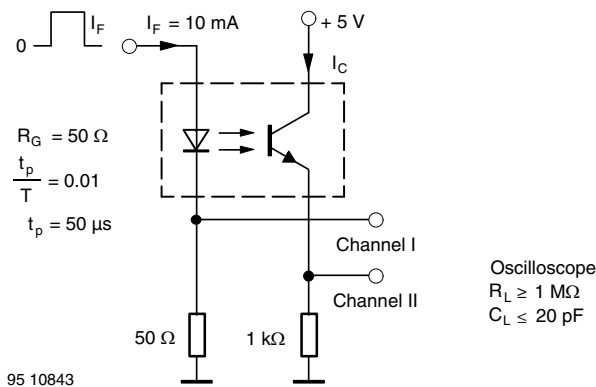


Fig. 5 - Test Circuit, Saturated Operation



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

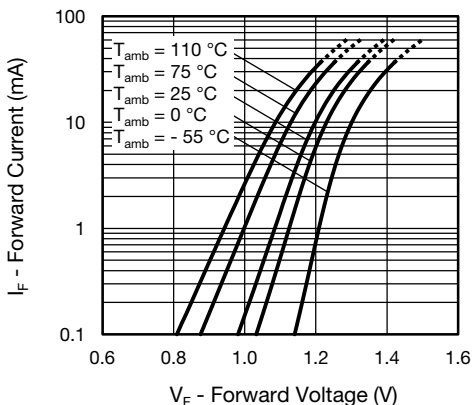


Fig. 7 - Forward Voltage vs. Forward Current

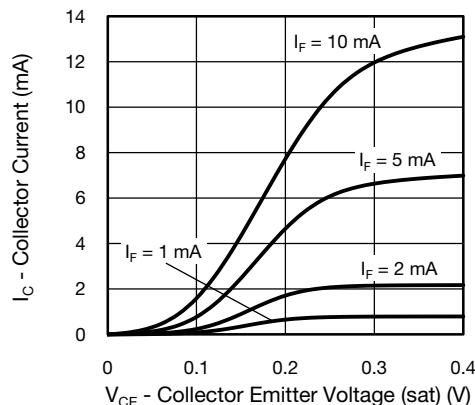


Fig. 10 - Collector Current vs. Collector Emitter Voltage (saturated)

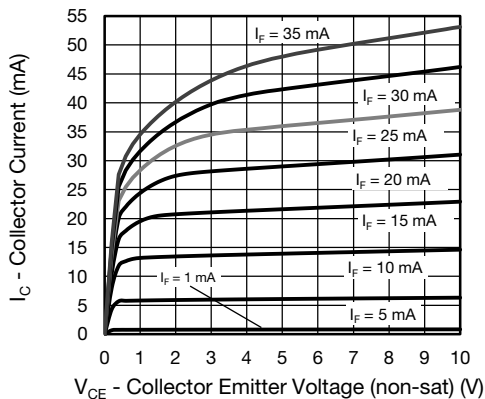


Fig. 8 - Collector Current vs. Collector Emitter Voltage (NS)

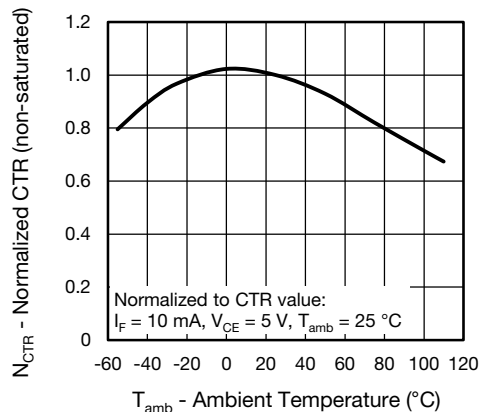


Fig. 11 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

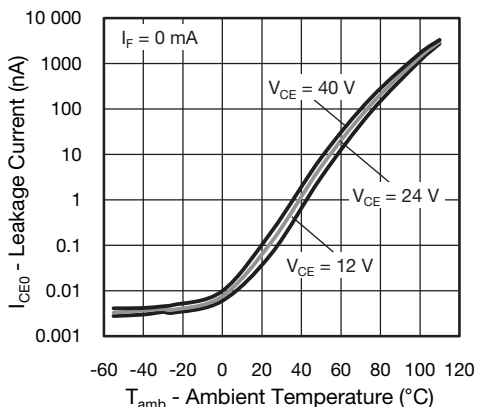


Fig. 9 - Leakage Current vs. Ambient Temperature

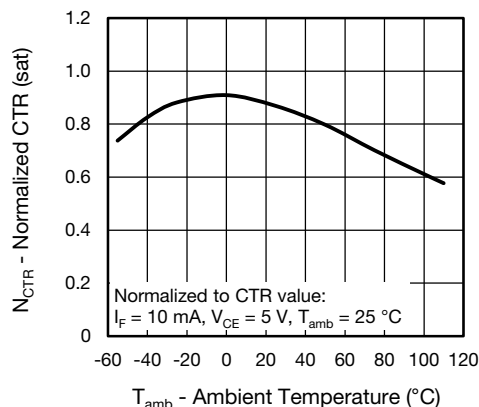


Fig. 12 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

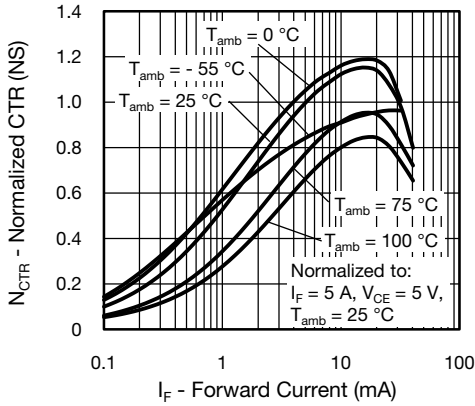


Fig. 13 - Normalized CTR (non-saturated) vs. Forward Current

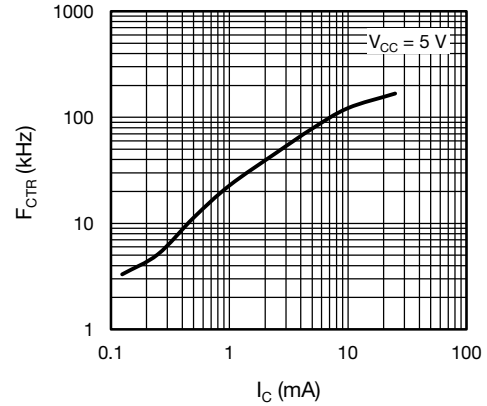


Fig. 16 - CTR Frequency vs. Collector Current

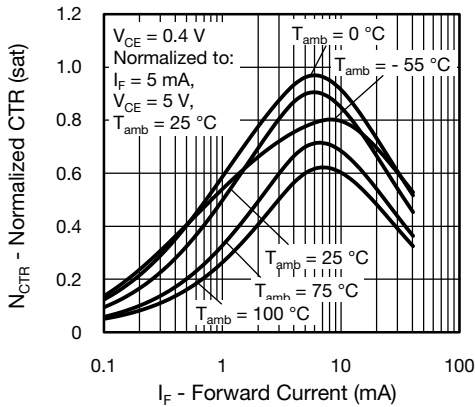


Fig. 14 - Normalized CTR (saturated) vs. Forward Current

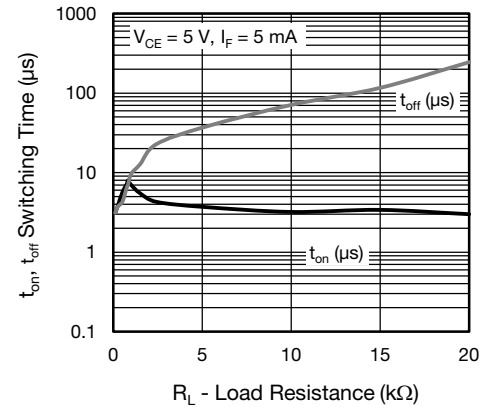


Fig. 17 - Switching Time vs. Load Resistance

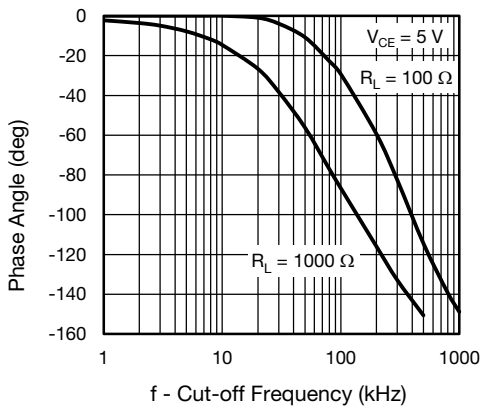


Fig. 15 - CTR Frequency vs. Phase Angle

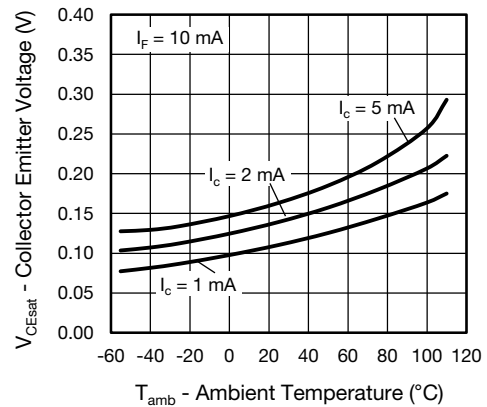
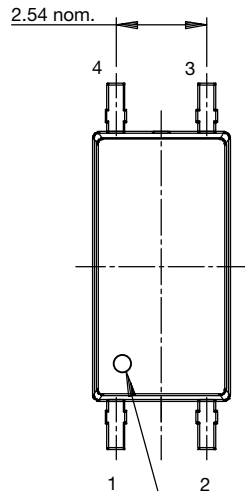
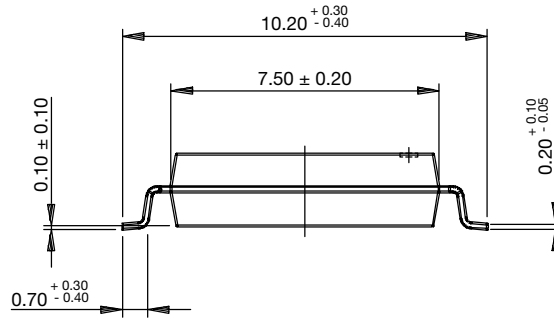
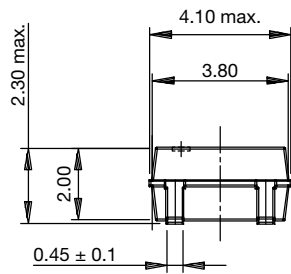


Fig. 18 - Collector Emitter Voltage vs. Ambient Temperature (saturated)



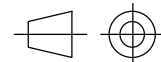
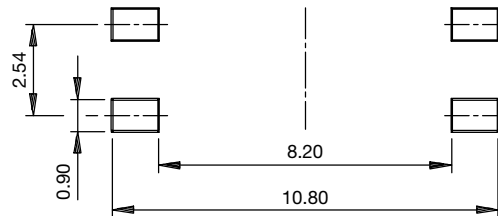
**PACKAGE DIMENSIONS** in millimeters



22533

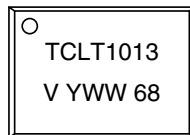
Pin no. 1 identification

Possible footprint



technical drawings according to DIN specifications

**PACKAGE MARKING** (Example of TCLT1013)





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