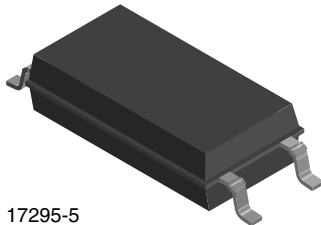
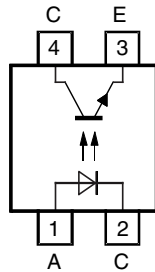


# Optocoupler, Phototransistor Output, 110 °C Rated, LSOP-4 Long Creepage Mini-Flat Package



17295-5


**DESCRIPTION**

The TCLT101. series consists of a GaAs infrared emitting diode, which is optically coupled to a phototransistor detector in a 4 pin mini-flat LSOP package.

**FEATURES**

- SMD low profile 4 lead package
- High isolation voltage  $V_{ISO} = 5000 V_{RMS}$
- CTR flexibility available see order information
- Isolation voltage  $V_{IORM} = 1050 V_{peak}$
- DC input with transistor output
- Temperature range  $-55\text{ }^{\circ}\text{C}$  to  $+110\text{ }^{\circ}\text{C}$
- Creepage distance  $\geq 8\text{ mm}$
- Extra low coupling capacitance
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)


**APPLICATIONS**

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

**AGENCY APPROVALS**

- [UL 1577](#)
- [cUL](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#)
- [BSI](#)
- [FIMKO](#)
- [CQC](#)

**LINKS TO ADDITIONAL RESOURCES**


ORDERING INFORMATION										
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="border: 1px solid black; padding: 2px 5px;">T</div> <div style="border: 1px solid black; padding: 2px 5px;">C</div> <div style="border: 1px solid black; padding: 2px 5px;">L</div> <div style="border: 1px solid black; padding: 2px 5px;">T</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> </div> <p style="text-align: center;">PART NUMBER</p>										
AGENCY CERTIFIED / PACKAGE	CTR (%)									
	5 mA	10 mA				5 mA				
UL, cUL, VDE, FIMKO	50 to 600	40 to 80	63 to 125	100 to 200	160 to 320	50 to 150	100 to 300	80 to 160	130 to 260	200 to 400
LSOP-4	TCLT1010	TCLT1011	TCLT1012	TCLT1013	TCLT1014	TCLT1015	TCLT1016	TCLT1017	TCLT1018	TCLT1019



ABSOLUTE MAXIMUM RATINGS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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>				
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>	$\leq 10\text{ s}$	$T_{sld}$	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> Refer to reflow profile for soldering conditions

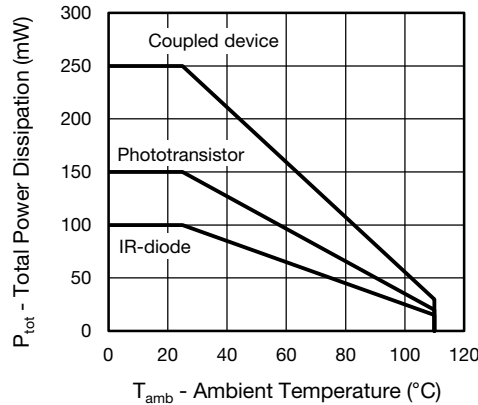


Fig. 1 - Total Power Dissipation vs. Ambient Temperature



<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.

<b>CURRENT TRANSFER RATIO</b> ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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	%
	$V_{CE} = 5\text{ V}$ , $I_F = 10\text{ mA}$	TCLT1011	CTR	40	-	80	%
		TCLT1012	CTR	63	-	125	%
		TCLT1013	CTR	100	-	200	%
		TCLT1014	CTR	160	-	320	%
	$V_{CE} = 5\text{ V}$ , $I_F = 1\text{ mA}$	TCLT1011	CTR	13	30	-	%
		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 RATINGS				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Climatic classification	According to IEC 68 part 1		55 / 110 / 21	
Pollution degree	According to DIN VDE 0109		2	
Comparative tracking index	Insulation group IIIa	CTI	175	
Maximum rated withstanding isolation voltage	According to UL1577, t = 1 min	$V_{ISO}$	5000	$V_{RMS}$
Maximum transient isolation voltage	According to DIN EN 60747-5-5	$V_{IOTM}$	8000	$V_{peak}$
Maximum repetitive peak isolation voltage	According to DIN EN 60747-5-5	$V_{IORM}$	1050	$V_{peak}$
Isolation resistance	$T_{amb} = 25\text{ }^{\circ}\text{C}, V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{12}$	$\Omega$
	$T_{amb} = 100\text{ }^{\circ}\text{C}, V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^{11}$	$\Omega$
	$T_{amb} = TS, V_{IO} = 500\text{ V}$	$R_{IO}$	$\geq 10^9$	$\Omega$
Output safety power		$P_{SO}$	265	mW
Input safety current		$I_{SI}$	130	mA
Input safety temperature		$T_S$	150	$^{\circ}\text{C}$
Creepage distance			$\geq 8$	mm
Clearance distance			$\geq 8$	mm
Insulation thickness		DTI	$\geq 0.4$	mm

**Note**

- According to DIN EN 60747-5-5 (VDE 0884), § 7.4.3.8.2, (see Fig. 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.

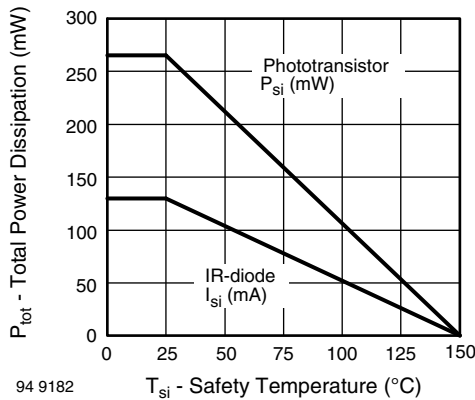


Fig. 2 - Derating Diagram

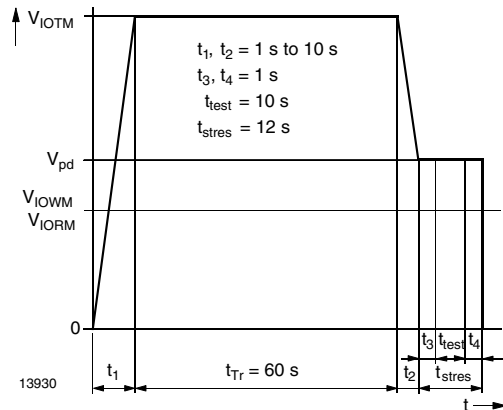
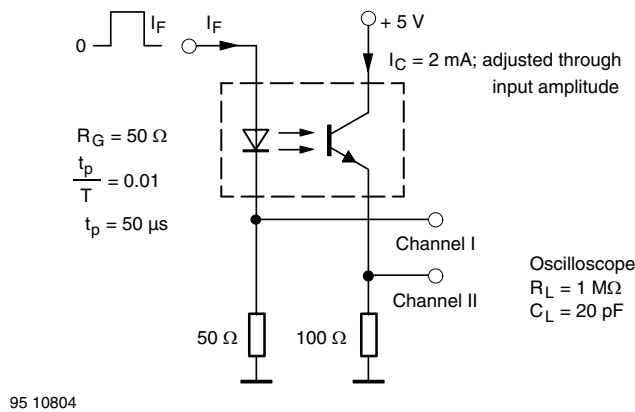


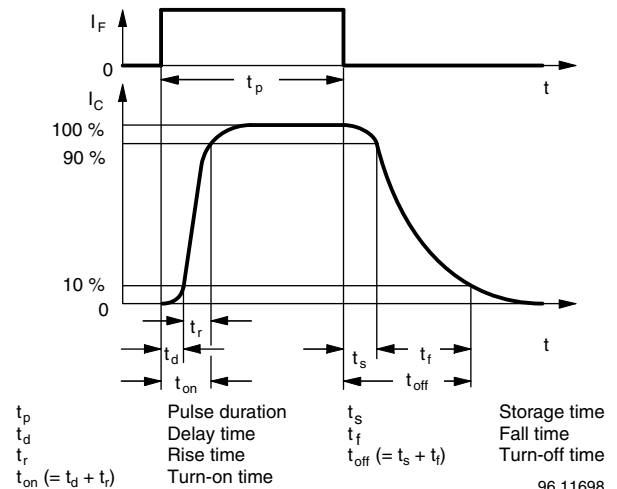
Fig. 3 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-5 (VDE 0884); IEC 60747-5-5

SWITCHING CHARACTERISTICS ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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 Fig. 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 Fig. 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 Fig. 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 Fig. 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 Fig. 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 Fig. 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 Fig. 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 Fig. 4)	$t_{off}$	-	10	-	$\mu\text{s}$



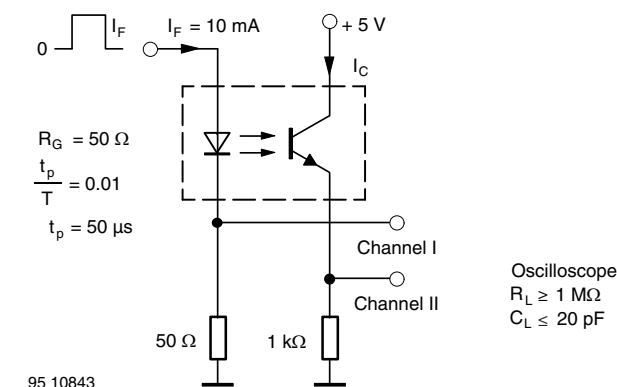
95 10804

Fig. 4 - Test Circuit, Non-Saturated Operation



96 11698

Fig. 6 - Switching Times



95 10843

Fig. 5 - Test Circuit, Saturated Operation

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

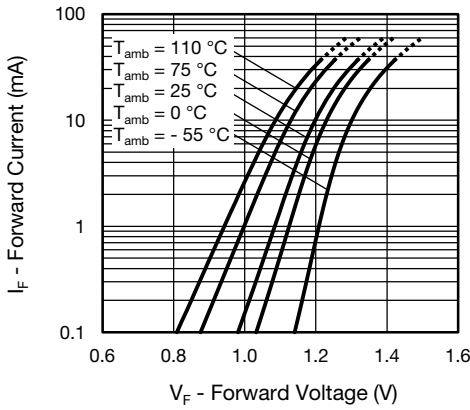


Fig. 7 - Forward Voltage vs. Forward Current

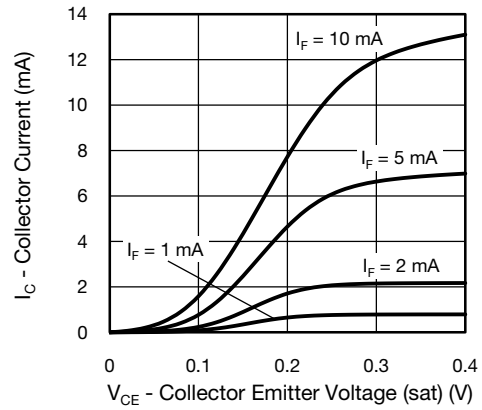


Fig. 10 - Collector Current vs. Collector Emitter Voltage (saturated)

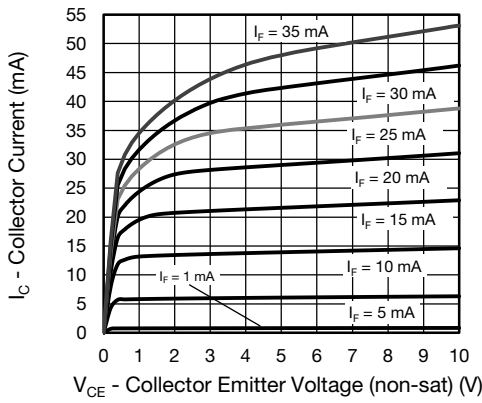


Fig. 8 - Collector Current vs. Collector Emitter Voltage (NS)

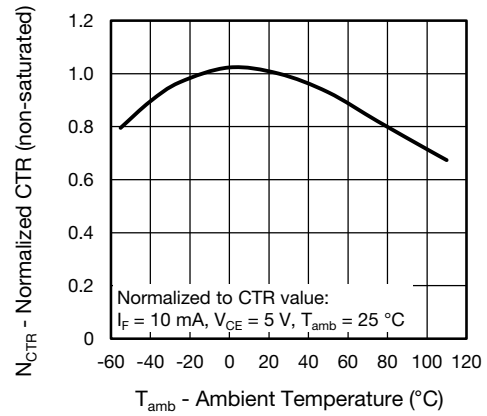


Fig. 11 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

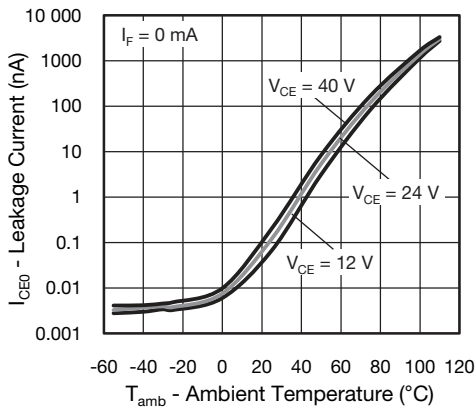


Fig. 9 - Leakage Current vs. Ambient Temperature

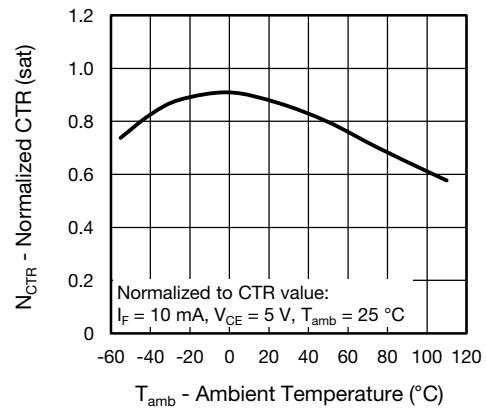


Fig. 12 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

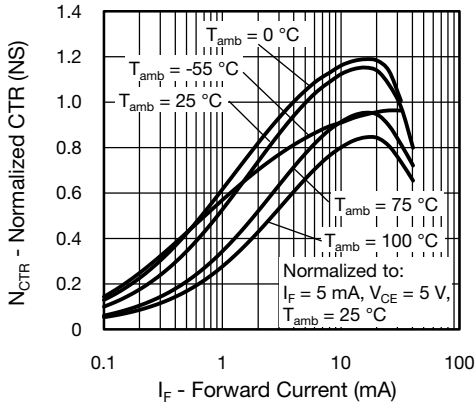


Fig. 13 - Normalized CTR (non-saturated) vs. Forward Current

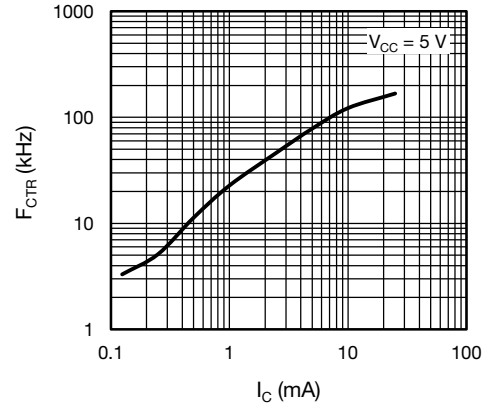


Fig. 16 - CTR Frequency vs. Collector Current

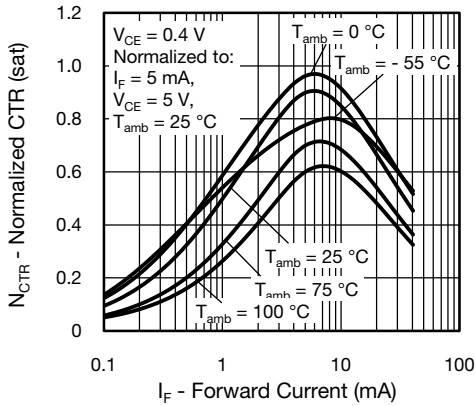


Fig. 14 - Normalized CTR (saturated) vs. Forward Current

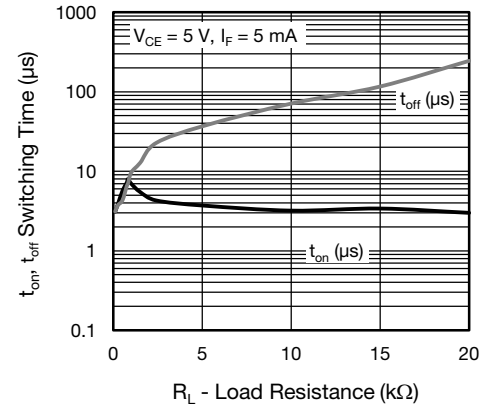


Fig. 17 - Switching Time vs. Load Resistance

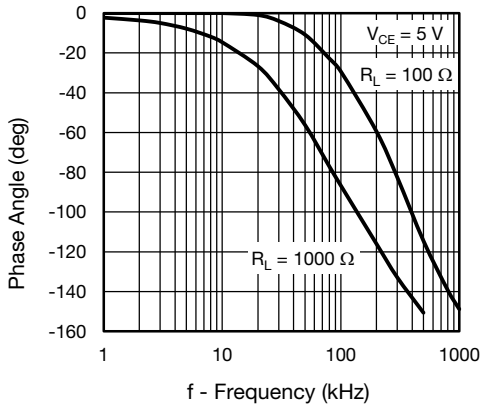


Fig. 15 - Phase Angle vs. Frequency

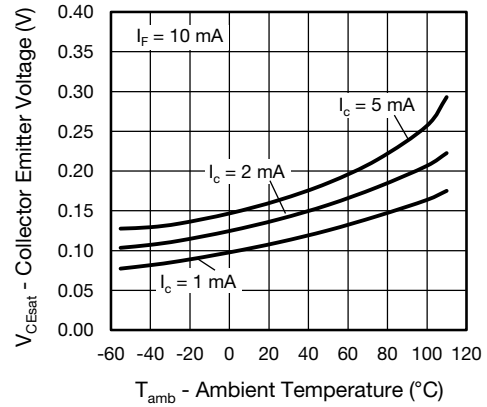
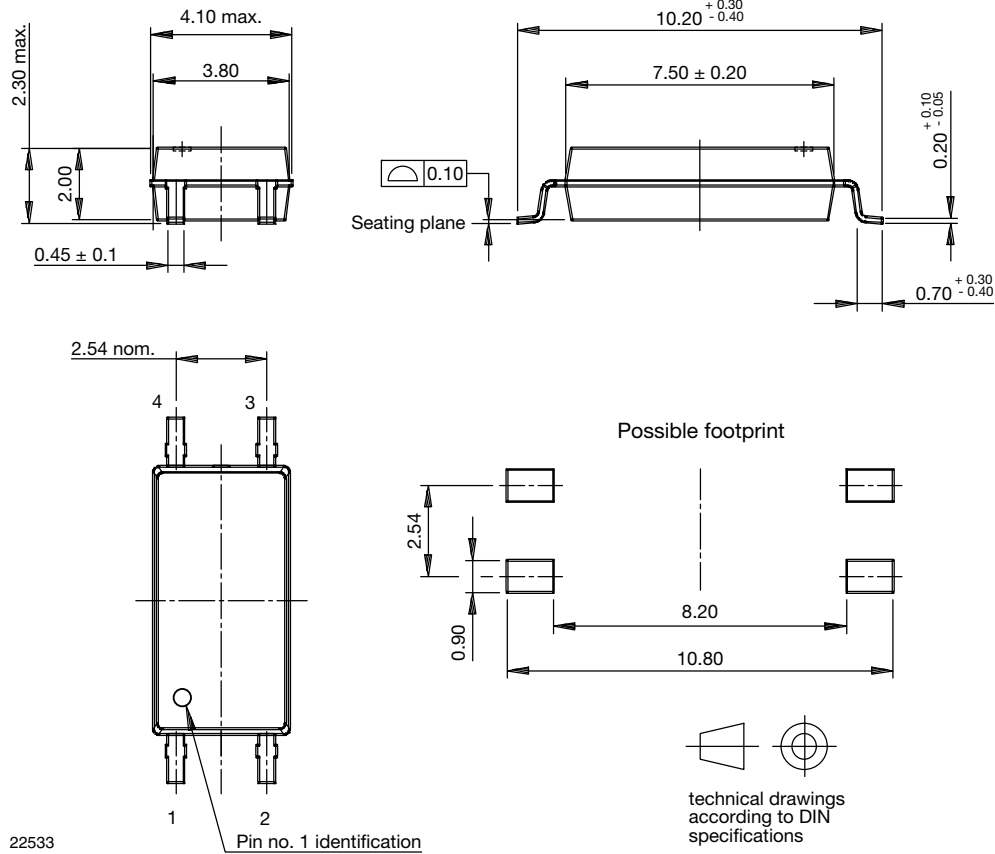
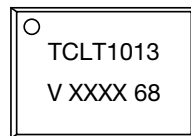


Fig. 18 - Collector Emitter Voltage vs. Ambient Temperature (saturated)

## PACKAGE DIMENSIONS (in millimeters)



## PACKAGE MARKING (example of TCLT1013)



### Note

- XXXX = LMC (lot marking code)

## TAPE AND REEL DIMENSIONS (in millimeters)

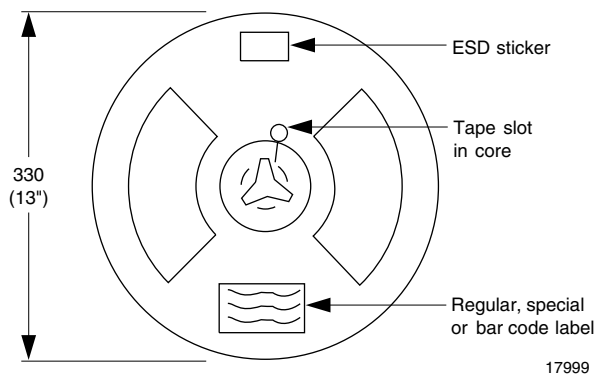


Fig. 19 - Reel Dimensions (3000 units per reel)

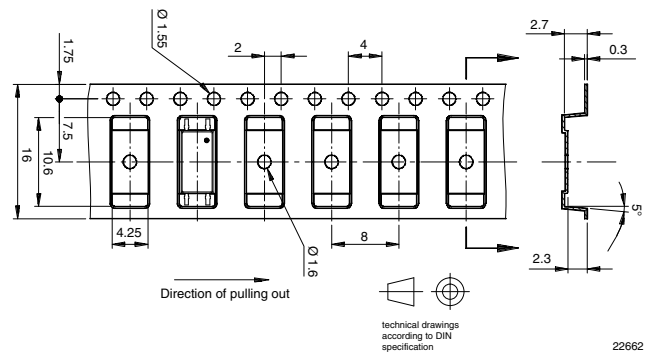
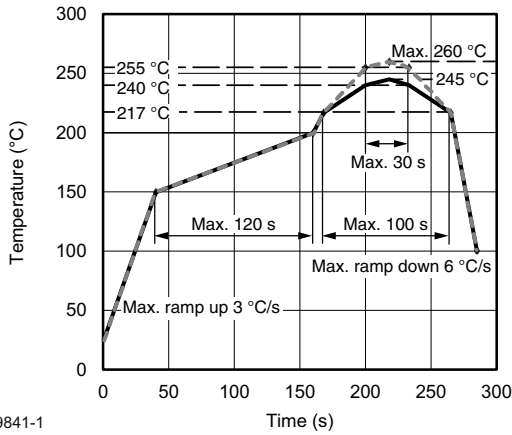


Fig. 20 - Tape Dimensions





**SOLDER PROFILE**



19841-1

Fig. 21 - Lead (Pb)-free Reflow Solder Profile according to J-STD-020

**HANDLING AND STORAGE CONDITIONS**

ESD level: HBM class 2

Floor life: unlimited

Conditions:  $T_{amb} < 30\text{ °C}$ ,  $RH < 85\%$

Moisture sensitivity level 1, according to J-STD-020



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