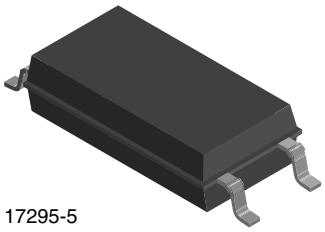
Optocoupler, Phototransistor Output, 110 °C Rated, LSOP-4 Long Creepage Mini-Flat Package



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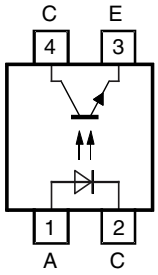


DESCRIPTION

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 °C to +110 °C
- Creepage distance ≥ 8 mm
- Extra low coupling capacitance
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS COMPLIANT

HALOGEN FREE GREEN (5-2008)

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

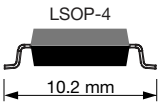
LINKS TO ADDITIONAL RESOURCES

Product Page | Design Tools | SPICE Models | Related Documents

ORDERING INFORMATION

T	C	L	T	1	0	1	#

PART NUMBER



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

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ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6	V
Forward current		I_F	60	mA
Forward surge current	$t_p \leq 10$ µs	I_{FSM}	1.5	A
Power dissipation		P_{diss}	100	mW
Junction temperature		T_j	125	°C
OUTPUT				
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
COUPLER				
Total power dissipation		P_{tot}	250	mW
Operating ambient temperature range		T_{amb}	-55 to +110	°C
Storage temperature range		T_{stg}	-55 to +125	°C
Soldering temperature [1]	≤ 10 s	T_{sld}	260	°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.

(1) Refer to reflow profile for soldering conditions

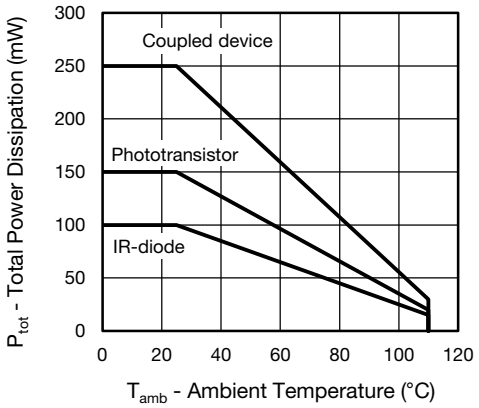

Fig. 1 - Total Power Dissipation vs. Ambient Temperature

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ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward voltage	I_F = 50 mA	V_F	-	1.25	1.6	V
Junction capacitance	V_R = 0 V, f = 1 MHz	C_j	-	50	-	pF
OUTPUT						
Collector emitter voltage	I_C = 1 mA	V_{CEO}	70	-	-	V
Emitter collector voltage	I_E = 100 µA	V_{ECO}	7	-	-	V
Collector emitter leakage current	V_{CE} = 20 V, I_F = 0 A	I_{CEO}	-	10	100	nA
COUPLER						
Collector emitter saturation voltage	I_F = 10 mA, I_C = 1 mA	V_{CEsat}	-	-	0.3	V
Cut-off frequency	V_{CE} = 5 V, I_F = 10 mA, R_L = 100 Ω	f_c	-	110	-	kHz
Coupling capacitance	f = 1 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 °C, unless otherwise specified)							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	V_{CE} = 5 V, I_F = 5 mA	TCLT1010	CTR	50	-	600	%
	V_{CE} = 5 V, I_F = 10 mA	TCLT1011	CTR	40	-	80	%
		TCLT1012	CTR	63	-	125	%
		TCLT1013	CTR	100	-	200	%
		TCLT1014	CTR	160	-	320	%
	V_{CE} = 5 V, I_F = 1 mA	TCLT1011	CTR	13	30	-	%
		TCLT1012	CTR	22	45	-	%
		TCLT1013	CTR	34	70	-	%
		TCLT1014	CTR	56	100	-	%
	V_{CE} = 5 V, I_F = 5 mA	TCLT1015	CTR	50	-	150	%
		TCLT1016	CTR	100	-	300	%
		TCLT1017	CTR	80	-	160	%
		TCLT1018	CTR	130	-	260	%
		TCLT1019	CTR	200	-	400	%

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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 °C, V_{IO} = 500 V	R_{IO}	$\geq 10^{12}$	Ω
	T_{amb} = 100 °C, V_{IO} = 500 V	R_{IO}	$\geq 10^{11}$	Ω
	T_{amb} = TS, V_{IO} = 500 V	R_{IO}	$\geq 10^{9}$	Ω
Output safety power		P_{SO}	265	mW
Input safety current		I_{SI}	130	mA
Input safety temperature		T_S	150	°C
Creepage distance			≥ 8	mm
Clearance distance			≥ 8	mm
Insulation thickness		DTI	≥ 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.

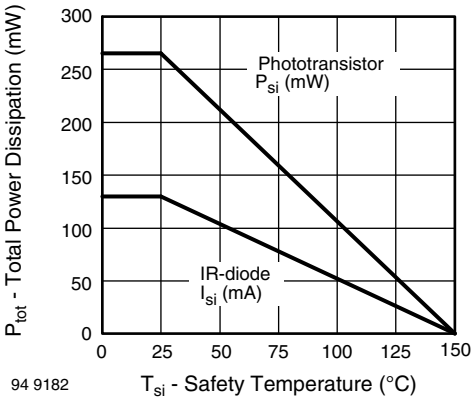

Fig. 2 - Derating Diagram

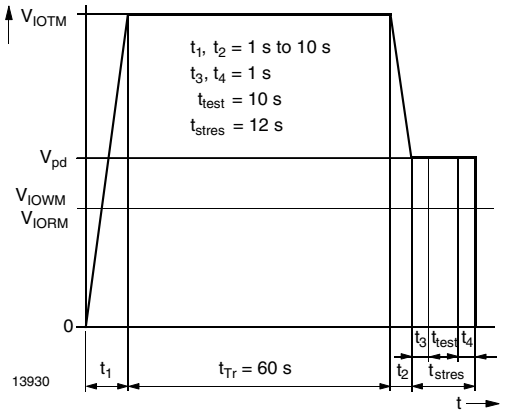

Fig. 3 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-5 (VDE 0884); IEC 60747-5-5

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SWITCHING CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Delay time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see 3)	t_d	-	3	-	µs
Rise time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 3)	t_r	-	3	-	µs
Fall time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 3)	t_f	-	4.7	-	µs
Storage time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 3)	t_s	-	0.3	-	µs
Turn-on time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 3)	t_{on}	-	6	-	µs
Turn-off time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 3)	t_{off}	-	5	-	µs
Turn-on time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ, (see Fig. 4)	t_{on}	-	9	-	µs
Turn-off time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ, (see Fig. 4)	t_{off}	-	10	-	µs

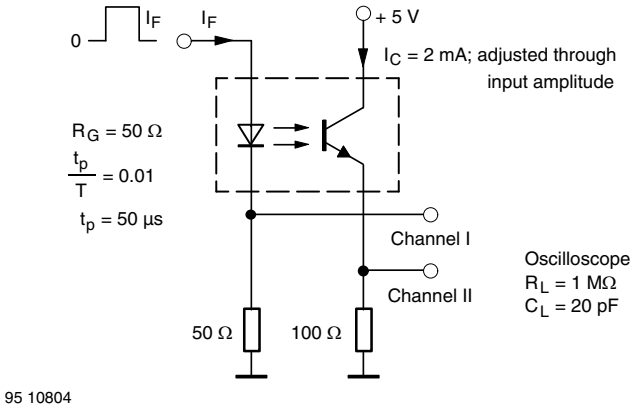

Fig. 4 - Test Circuit, Non-Saturated Operation

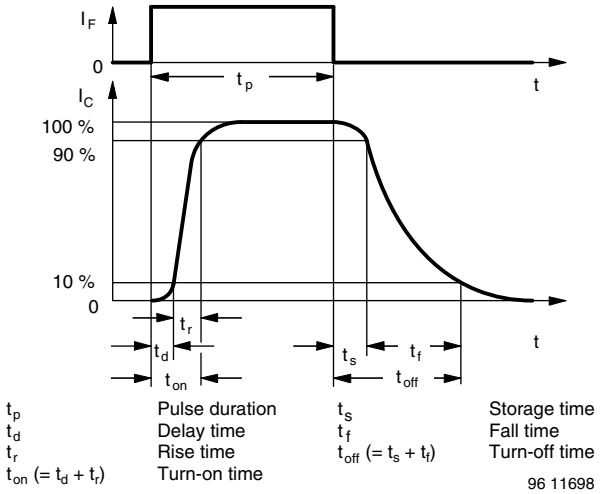

Fig. 6 - Switching Times

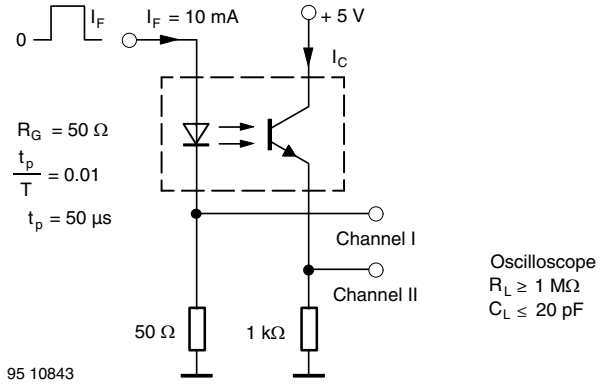

Fig. 5 - Test Circuit, Saturated Operation

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TYPICAL CHARACTERISTICS (T_{amb} = 25 °C, unless otherwise specified)

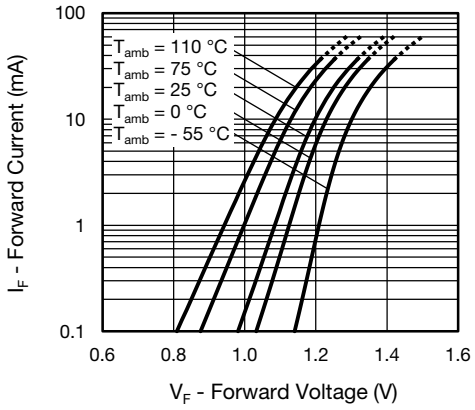

Fig. 7 - Forward Voltage vs. Forward Current

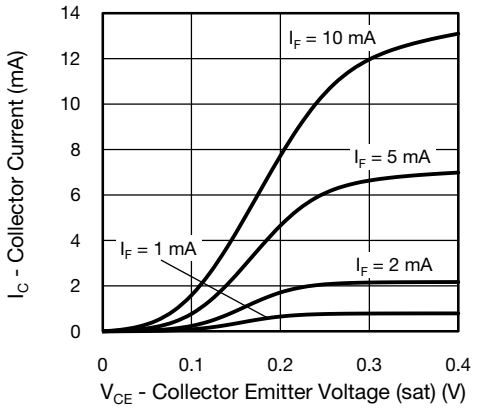

Fig. 10 - Collector Current vs. Collector Emitter Voltage (saturated)

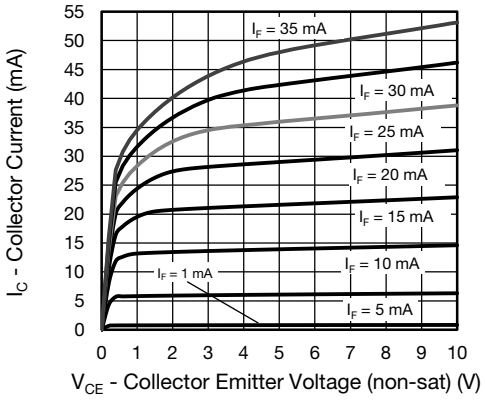

Fig. 8 - Collector Current vs. Collector Emitter Voltage (NS)

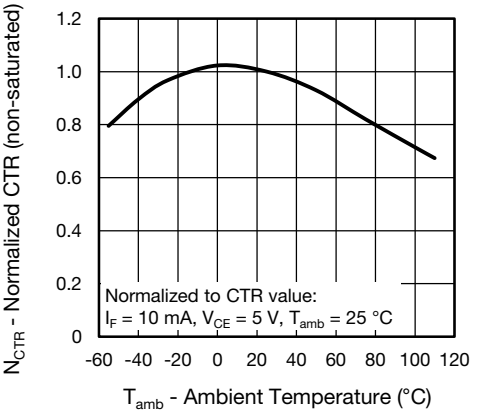

Fig. 11 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

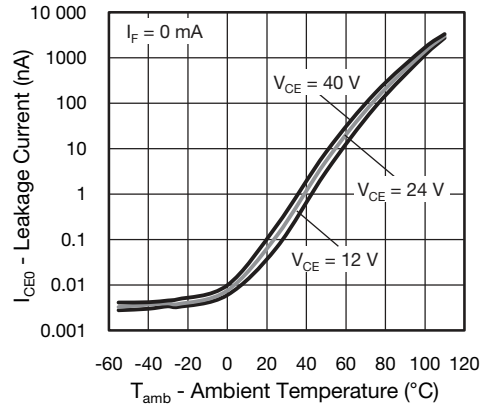

Fig. 9 - Leakage Current vs. Ambient Temperature

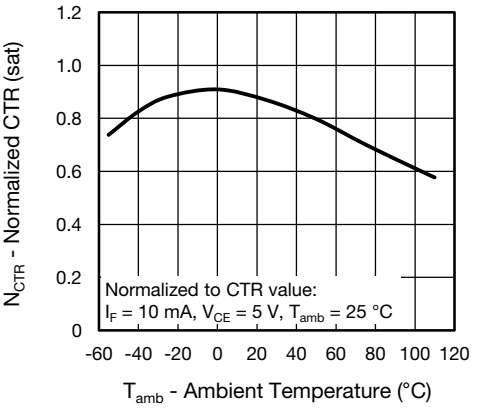

Fig. 12 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

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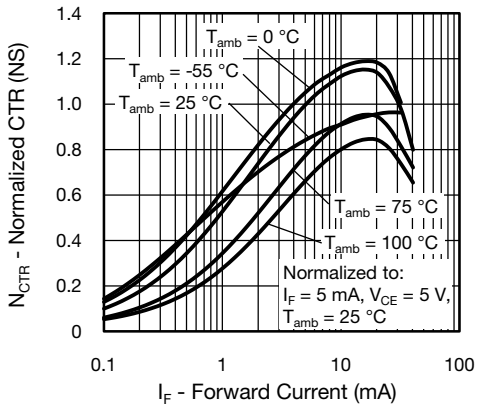

Fig. 13 - Normalized CTR (non-saturated) vs. Forward Current

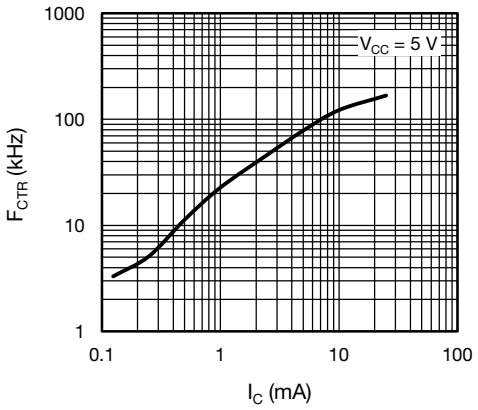

Fig. 16 - CTR Frequency vs. Collector Current

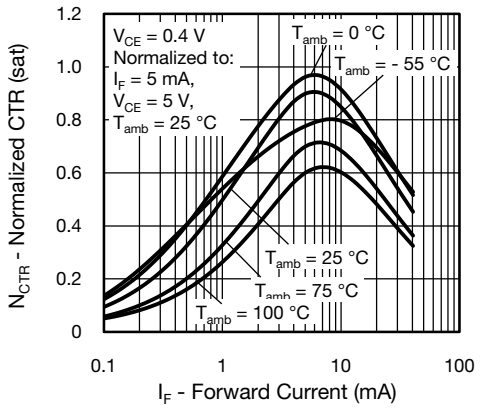

Fig. 14 - Normalized CTR (saturated) vs. Forward Current

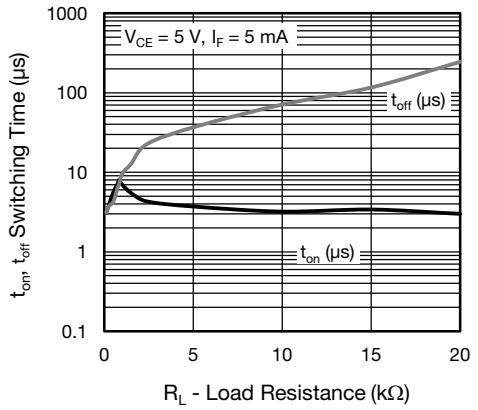

Fig. 17 - Switching Time vs. Load Resistance

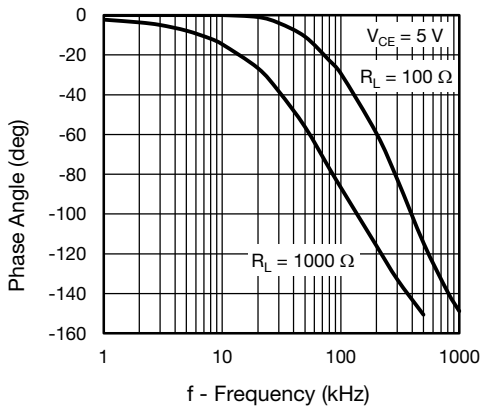

Fig. 15 - Phase Angle vs. Frequency

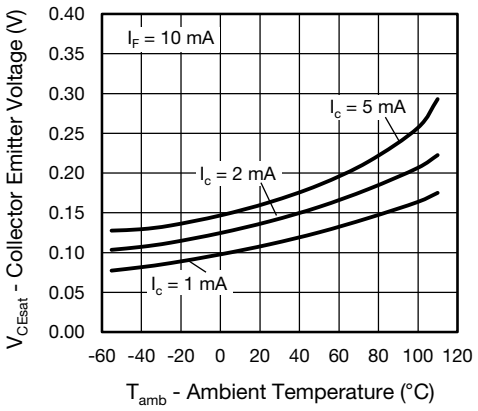

Fig. 18 - Collector Emitter Voltage vs. Ambient Temperature (saturated)

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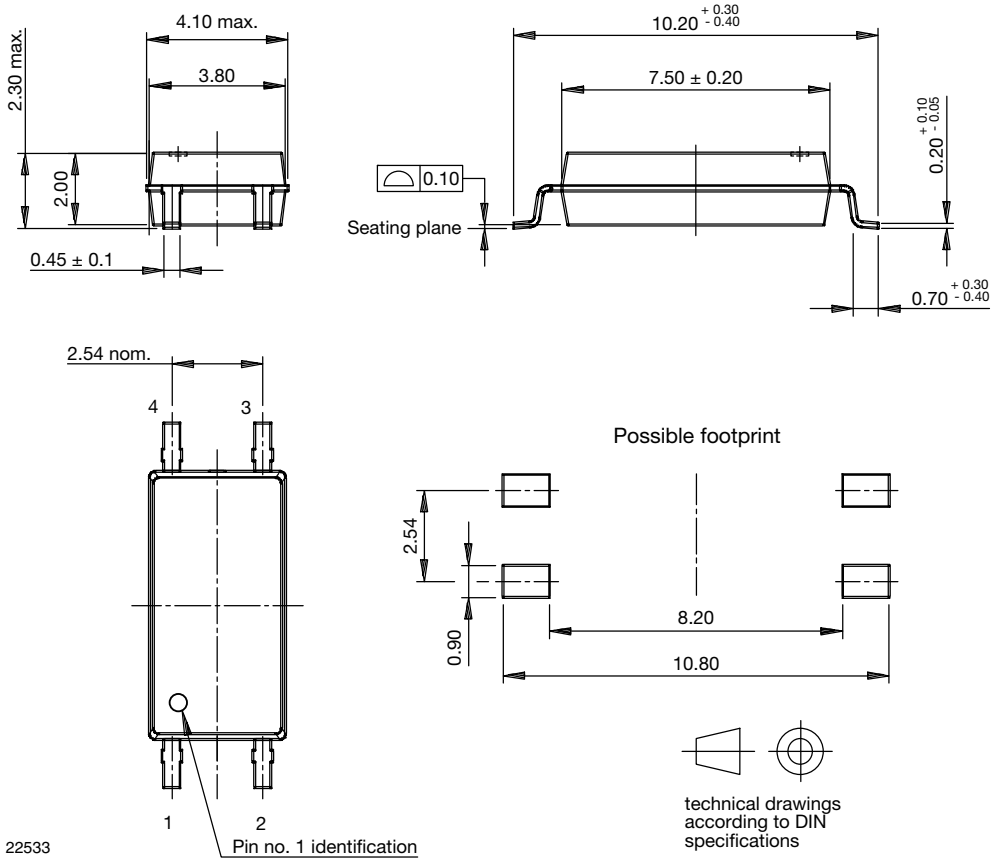
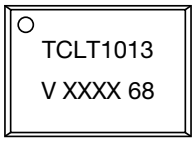
PACKAGE DIMENSIONS (in millimeters)



PACKAGE MARKING (example of TCLT1013)



Note

- XXXX = LMC (lot marking code)

TAPE AND REEL DIMENSIONS (in millimeters)

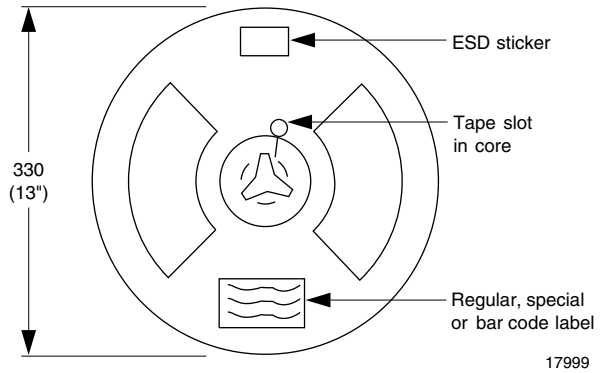


Fig. 19 - Reel Dimensions (3000 units per reel)

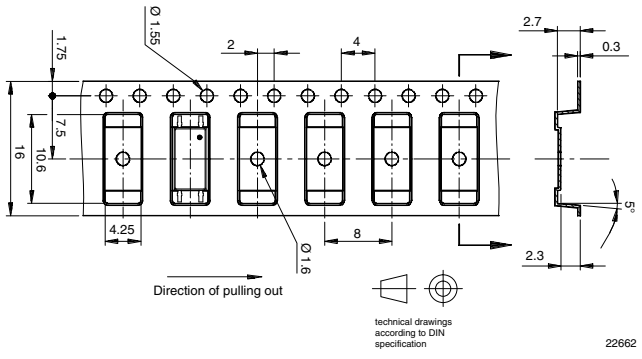


Fig. 20 - Tape Dimensions

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SOLDER PROFILE

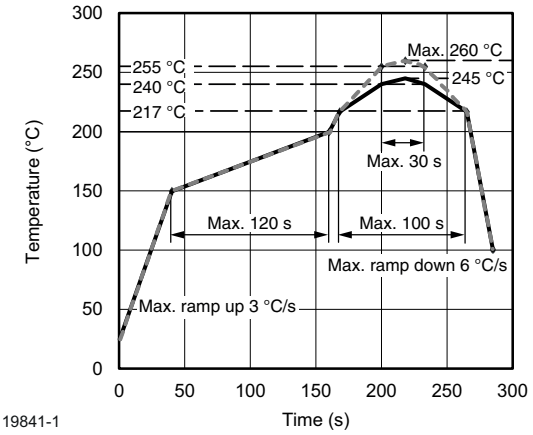

Fig. 21 - Lead (Pb)-free Reflow Solder Profile according to J-STD-020

HANDLING AND STORAGE CONDITIONS

ESD level: HBM class 2

Floor life: unlimited

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

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

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