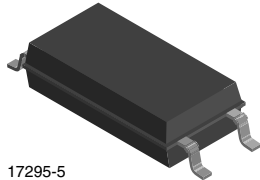
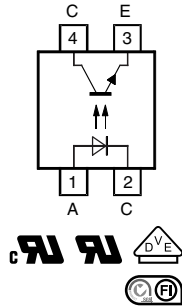


Optocoupler, Phototransistor Output, LSOP-4, 110 °C Rated, Long Mini-Flat Package



17295-5



FEATURES

- SMD low profile 4 lead package
- High isolation 5000 V_{RMS}
- CTR flexibility available see order information
- 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



DESCRIPTION

The TCLT101. series consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-lead LSOP 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
- FIMKO: EN 60950

| 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 | 63 to 125 | 100 to 200 | 50 to 150 | 100 to 300 | 80 to 160 | 130 to 260 | 200 to 400 |
| LSOP-4 | TCLT1010 | TCLT1012 | TCLT1013 | TCLT1015 | TCLT1016 | TCLT1017 | TCLT1018 | TCLT1019 |

| 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 ≤ 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 ≤ 10 ms | I _{CM} | 100 | mA |
| Power dissipation | | P _{diss} | 150 | mW |
| Junction temperature | | T _j | 125 | °C |



| ABSOLUTE MAXIMUM RATINGS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | |
|--|----------------|------------|-------------|--------------------|
| PARAMETER | TEST CONDITION | SYMBOL | VALUE | UNIT |
| COUPLER | | | | |
| 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 ⁽¹⁾ | | T_{slid} | 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.
- ⁽¹⁾ Wave soldering three cycles are allowed. Also refer to "Assembly Instruction" (www.vishay.com/doc?80054).

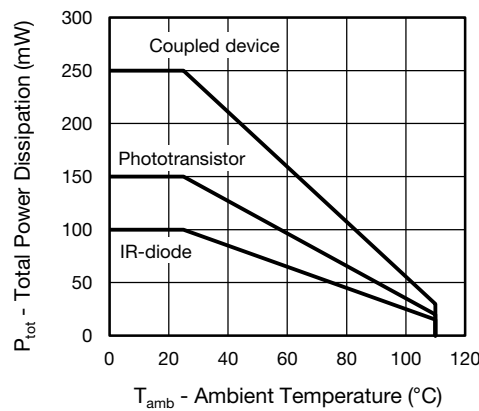


Fig. 1 - Total Power Dissipation vs. Ambient Temperature

| ELECTRICAL CHARACTERISTICS ($T_{amb} = 25\text{ }^{\circ}\text{C}$, unless otherwise specified) | | | | | | |
|--|--|-------------|------|------|------|------|
| PARAMETER | TEST CONDITION | SYMBOL | MIN. | TYP. | MAX. | UNIT |
| INPUT | | | | | | |
| 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 |
| OUTPUT | | | | | | |
| 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 |
| COUPLER | | | | | | |
| 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 | % |
| | $V_{CE} = 5\text{ V}, I_F = 10\text{ mA}$ | TCLT1012 | CTR | 63 | - | 125 | % |
| | | TCLT1013 | CTR | 100 | - | 200 | % |
| | $V_{CE} = 5\text{ V}, I_F = 1\text{ mA}$ | TCLT1012 | CTR | 22 | 45 | - | % |
| | | TCLT1013 | CTR | 34 | 70 | - | % |
| | $V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$ | 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 |
| 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 |
| Isolation test voltage (RMS) | | V_{ISO} | 5000 | V_{RMS} |
| Insulation resistance | $V_{IO} = 500\text{ V}$ | R_{IO} | 10^{12} | Ω |
| | $V_{IO} = 500\text{ V}, T_{amb} = 100\text{ }^{\circ}\text{C}$ | R_{IO} | 10^{11} | Ω |
| | $V_{IO} = 500\text{ V}, T_{amb} = 150\text{ }^{\circ}\text{C}$ (construction test only) | R_{IO} | 10^9 | Ω |
| 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.

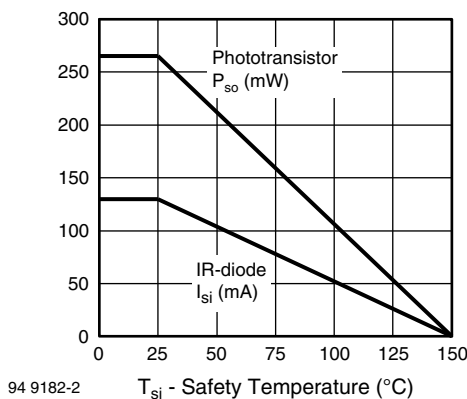


Fig. 2 - Derating Diagram

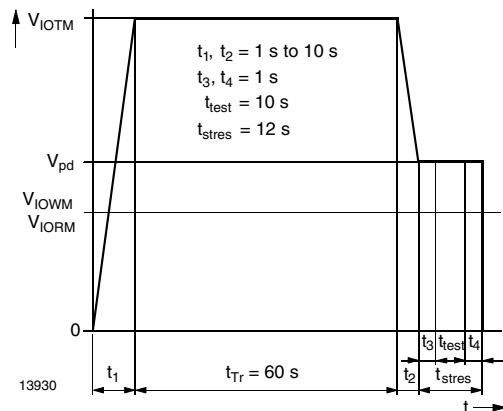


Fig. 3 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-2 (VDE 0884); IEC 60747-5-5

| 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 figure 3) | t_d | - | 3 | - | μs |
| Rise time | $V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\text{ }\Omega$, (see figure 3) | t_r | - | 3 | - | μs |
| Fall time | $V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\text{ }\Omega$, (see figure 3) | t_f | - | 4.7 | - | μs |
| Storage time | $V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\text{ }\Omega$, (see figure 3) | t_s | - | 0.3 | - | μs |
| Turn-on time | $V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\text{ }\Omega$, (see figure 3) | t_{on} | - | 6 | - | μs |
| Turn-off time | $V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\text{ }\Omega$, (see figure 3) | t_{off} | - | 5 | - | μs |
| 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 | - | μs |
| 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 | - | μs |

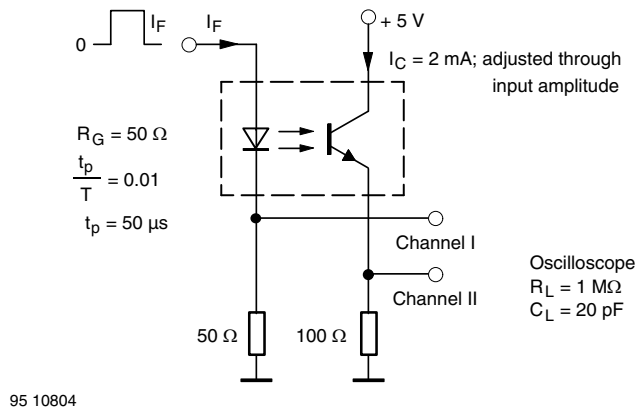


Fig. 4 - Test Circuit, Non-Saturated Operation

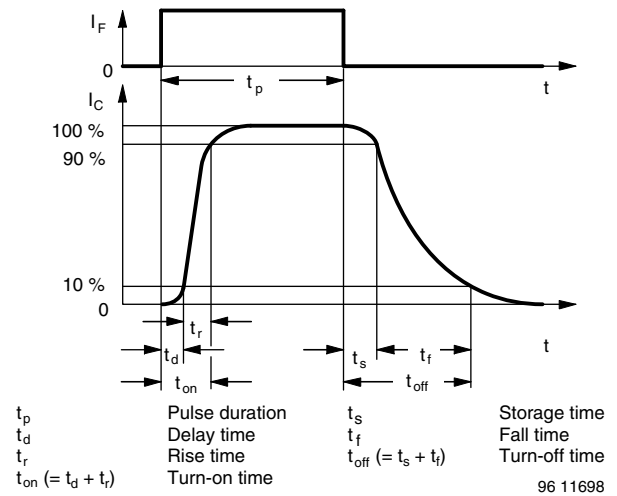


Fig. 6 - Switching Times

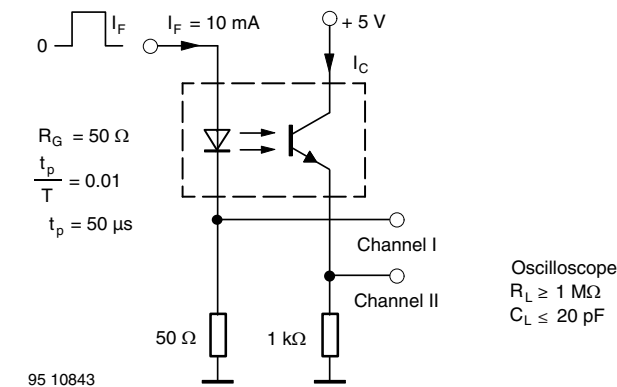


Fig. 5 - Test Circuit, Saturated Operation



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

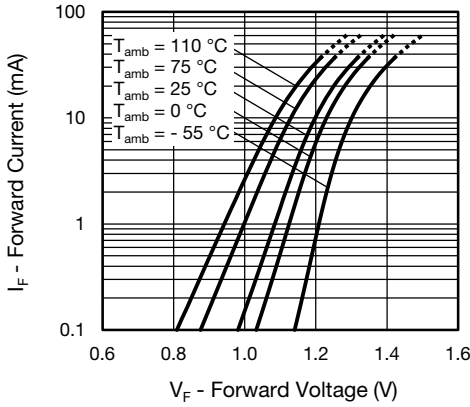


Fig. 7 - Forward Voltage vs. Forward Current

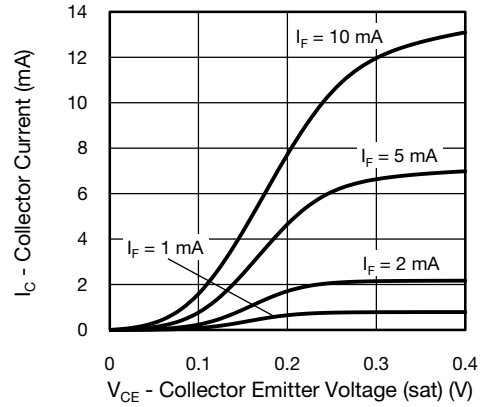


Fig. 10 - Collector Current vs. Collector Emitter Voltage (saturated)

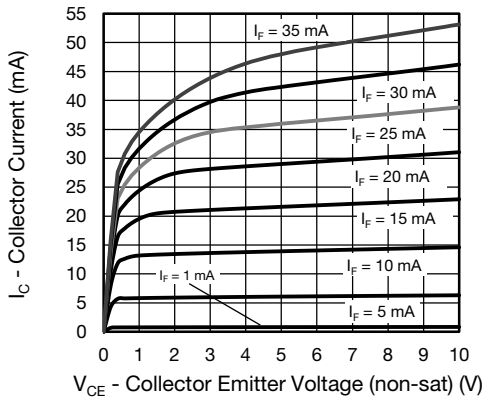


Fig. 8 - Collector Current vs. Collector Emitter Voltage (NS)

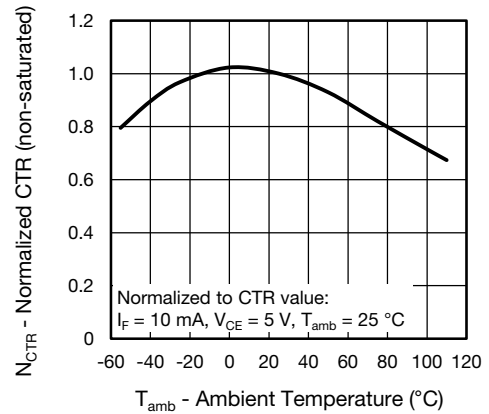


Fig. 11 - Normalized Current Transfer Ratio (non-saturated) vs. Ambient Temperature

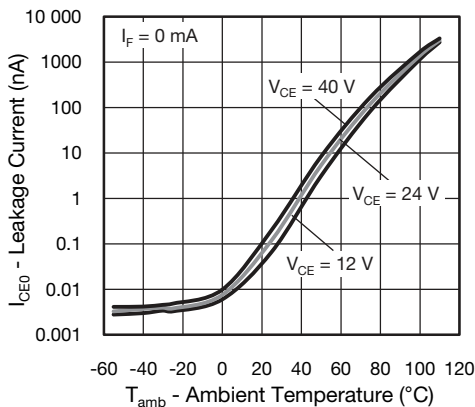


Fig. 9 - Leakage Current vs. Ambient Temperature

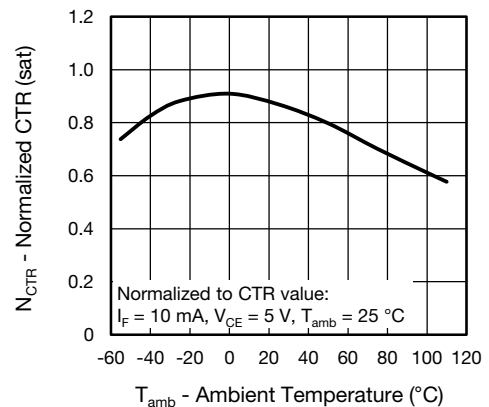


Fig. 12 - Normalized Current Transfer Ratio (saturated) vs. Ambient Temperature

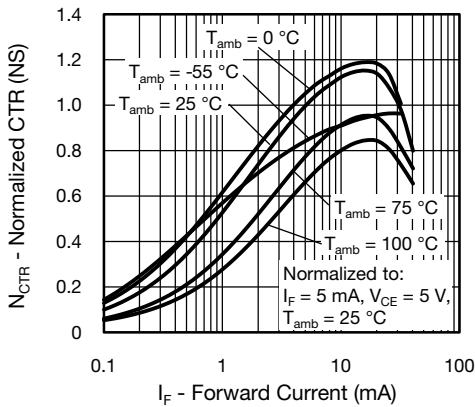


Fig. 13 - Normalized CTR (non-saturated) vs. Forward Current

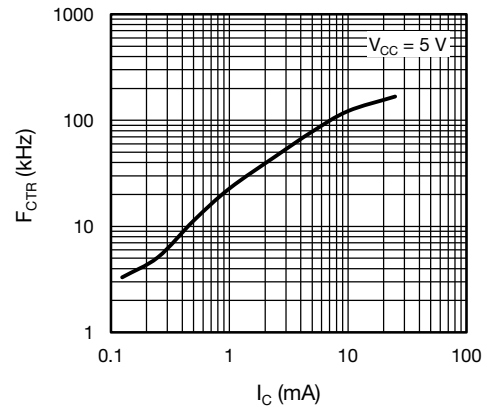


Fig. 16 - CTR Frequency vs. Collector Current

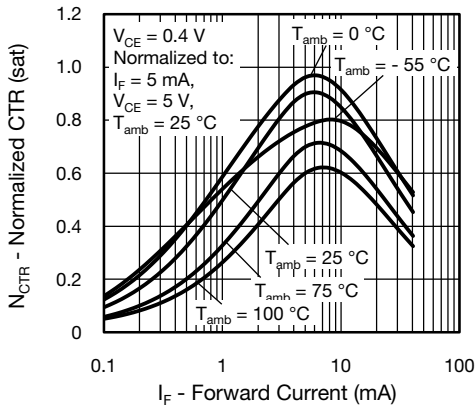


Fig. 14 - Normalized CTR (saturated) vs. Forward Current

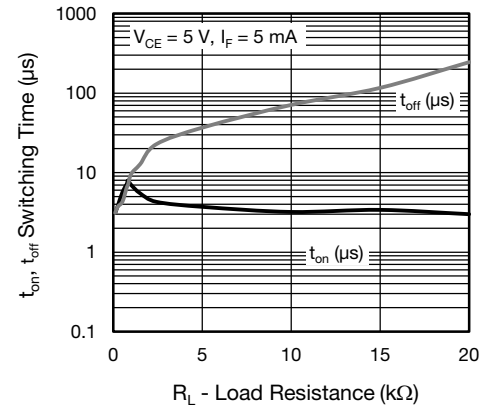


Fig. 17 - Switching Time vs. Load Resistance

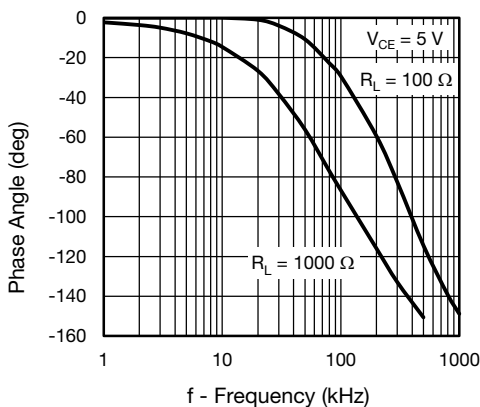


Fig. 15 - Phase Angle vs. Frequency

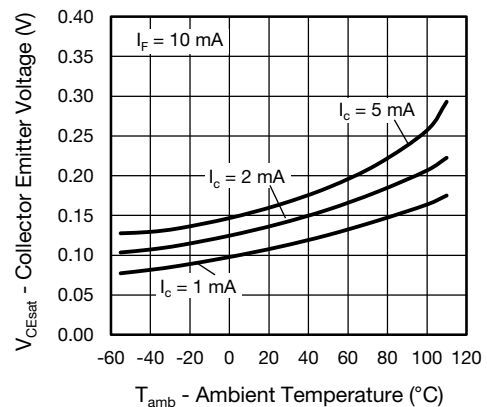
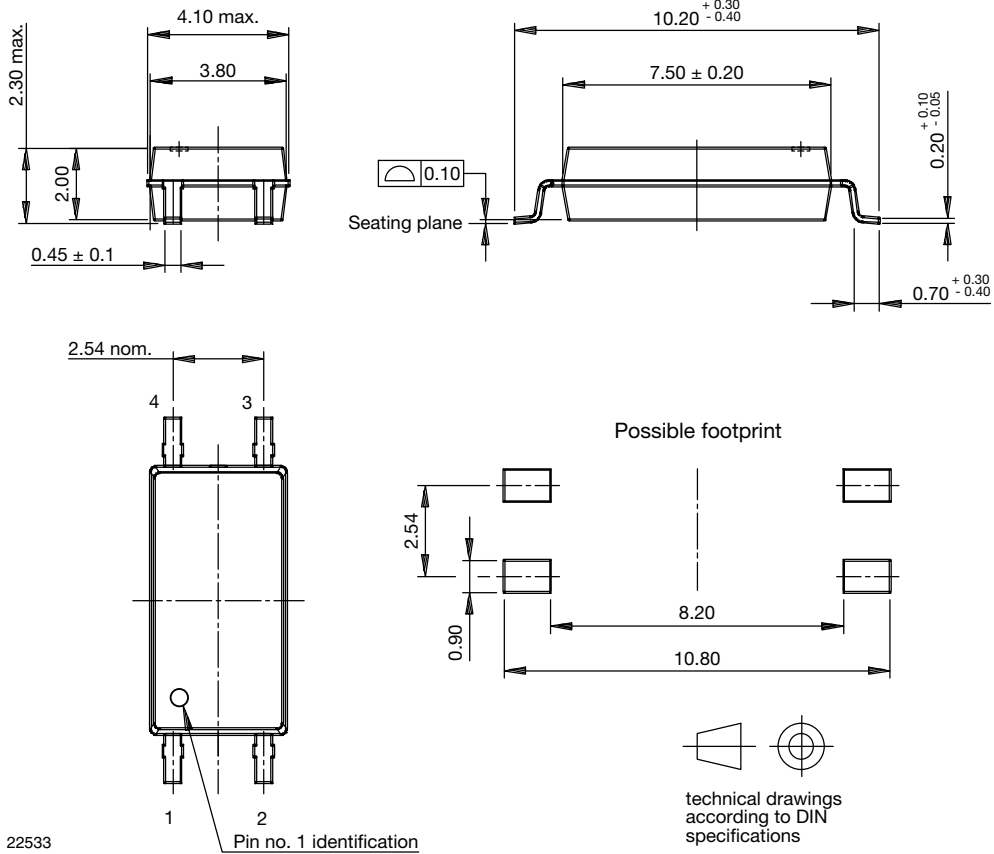
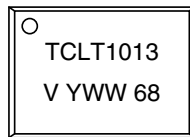


Fig. 18 - Collector Emitter Voltage vs. Ambient Temperature (saturated)

PACKAGE DIMENSIONS (in millimeters)



PACKAGE MARKING (example of TCLT1013)



TAPE AND REEL DIMENSIONS (in millimeters)

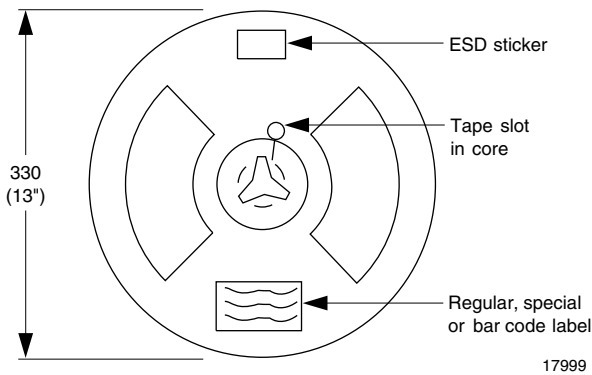


Fig. 19 - Reel Dimensions (3000 units per reel)

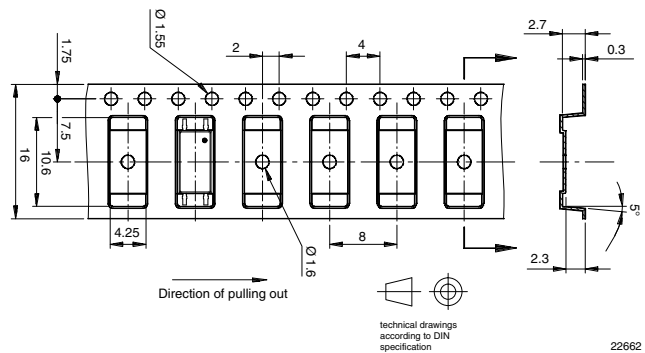
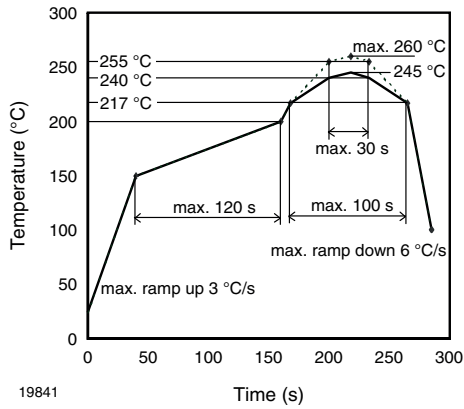


Fig. 20 - Tape Dimensions

SOLDER PROFILE



19841

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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