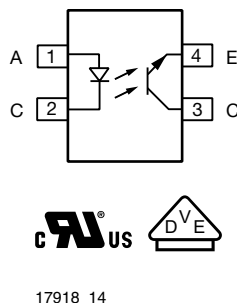
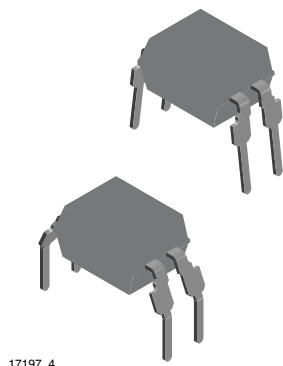


## Optocoupler, Phototransistor Output



### DESCRIPTION

The TCET1200 consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4 pin plastic dual inline package.

### VDE STANDARDS

These couplers perform safety functions according to the following equipment standards:

- **DIN EN 60747-5-2 (VDE 0884)**  
Optocoupler for electrical safety requirements
- **IEC 60950/EN 60950**  
Office machines (applied for reinforced isolation for mains voltage  $\leq 400 V_{RMS}$ )
- **VDE 0804**  
Telecommunication apparatus and data processing
- **IEC 60065**  
Safety for mains-operated electronic and related household apparatus

### FEATURES

- High common mode rejection
- CTR offered in 5 groups
- Low temperature coefficient of CTR
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC



**RoHS**  
COMPLIANT

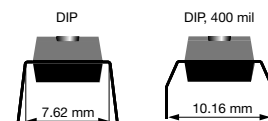
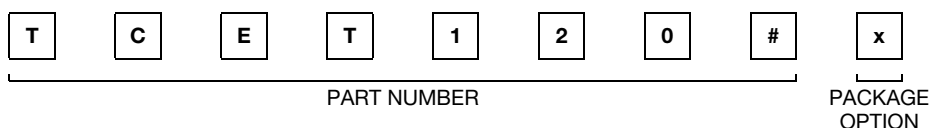
### APPLICATIONS

- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface
- Reinforced isolation provides circuit protection against electrical shock (safety class II)
- Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):
  - for appl. class I - IV at mains voltage  $\leq 300 V$
  - for appl. class I - III at mains voltage  $\leq 600 V$  according to DIN EN 60747-5-2 (VDE 0884)

### AGENCY APPROVALS

- UL1577, file no. E52744, double protection
- cUL tested to CSA 22.2 bulletin 5A, double protection
- BSI IEC 60950; IEC 60065 pending
- DIN EN 60747-5-2 (VDE 0884)  
DIN EN 60747-5-5 (pending)
- FIMKO

### ORDERING INFORMATION



| AGENCY CERTIFIED/PACKAGE | CTR (%)   |           |           |            |            |
|--------------------------|-----------|-----------|-----------|------------|------------|
|                          | 5 mA      | 10 mA     |           |            |            |
| UL, VDE, BSI, FIMKO      | 50 to 600 | 40 to 80  | 63 to 125 | 100 to 200 | 160 to 320 |
| DIP-4                    | TCET1200  | TCET1201  | TCET1202  | TCET1203   | TCET1204   |
| DIP-4, 400 mil           | TCET1200G | TCET1201G | TCET1202G | TCET1203G  | TCET1204G  |

#### Note

- G = leadform 10.16 mm; G is not marked on the body.

| <b>ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup></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                                                                                                     |                                      | $P_{diss}$ | 70            | 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                                                                                                     |                                      | $P_{diss}$ | 70            | mW                 |
| Junction temperature                                                                                                  |                                      | $T_j$      | 125           | $^{\circ}\text{C}$ |
| <b>COUPLER</b>                                                                                                        |                                      |            |               |                    |
| Isolation test voltage (RMS)                                                                                          |                                      | $V_{ISO}$  | 5000          | $V_{RMS}$          |
| Total power dissipation                                                                                               |                                      | $P_{tot}$  | 200           | mW                 |
| Operating ambient temperature range                                                                                   |                                      | $T_{amb}$  | - 40 to + 100 | $^{\circ}\text{C}$ |
| Storage temperature range                                                                                             |                                      | $T_{stg}$  | - 55 to + 125 | $^{\circ}\text{C}$ |
| Soldering temperature <sup>(2)</sup>                                                                                  | 2 mm from case, $t \leq 10\text{ s}$ | $T_{sld}$  | 260           | $^{\circ}\text{C}$ |

### Notes

<sup>(1)</sup> 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>(2)</sup> Refer to wave profile for soldering conditions for through hole devices.

| <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                                                                        | $V_{CE} = 20\text{ V}, I_F = 0\text{ A}, E = 0$                    | $I_{CEO}$   |      | 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                                                                                     | $f = 1\text{ MHz}$                                                 | $C_k$       |      | 0.6  |      | pF   |

### Note

- Minimum and maximum values were tested requirements. Typical values are characteristics of the device and are the result of engineering evaluations. 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 |
|-----------|-------------------------------------------|-----------|--------|------|------|------|------|
| $I_C/I_F$ | $V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$  | TCET1200  | CTR    | 50   |      | 600  | %    |
|           |                                           | TCET1200G | CTR    |      |      |      |      |
|           | $V_{CE} = 5\text{ V}, I_F = 10\text{ mA}$ | TCET1201  | CTR    | 40   |      | 80   | %    |
|           |                                           | TCET1201G | CTR    |      |      |      |      |
|           |                                           | TCET1202  | CTR    | 63   |      | 125  | %    |
|           |                                           | TCET1202G | CTR    |      |      |      |      |
|           |                                           | TCET1203  | CTR    | 100  |      | 200  | %    |
|           |                                           | TCET1203G | CTR    |      |      |      |      |
|           |                                           | TCET1204  | CTR    | 160  |      | 320  | %    |
|           |                                           | TCET1204G | CTR    |      |      |      |      |

### SAFETY AND INSULATION RATED PARAMETERS

| PARAMETER                                               | TEST CONDITION                                                                                         | SYMBOL            | MIN.      | TYP. | MAX. | UNIT             |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------|-------------------|-----------|------|------|------------------|
| Partial discharge test voltage - routine test           | 100 %, $t_{\text{test}} = 1\text{ s}$                                                                  | $V_{\text{pd}}$   | 1.6       |      |      | kV               |
| Partial discharge test voltage - lot test (sample test) | $t_{\text{Tr}} = 60\text{ s}, t_{\text{test}} = 10\text{ s}$ ,<br>(see figure 2)                       | $V_{\text{pd}}$   | 1.36      |      |      | kV               |
| Insulation resistance                                   | $V_{\text{IO}} = 500\text{ V}$                                                                         | $R_{\text{IO}}$   | $10^{12}$ |      |      | $\Omega$         |
|                                                         | $V_{\text{IO}} = 500\text{ V}, T_{\text{amb}} = 100\text{ }^\circ\text{C}$                             | $R_{\text{IO}}$   | $10^{11}$ |      |      | $\Omega$         |
|                                                         | $V_{\text{IO}} = 500\text{ V}, T_{\text{amb}} = 150\text{ }^\circ\text{C}$<br>(construction test only) | $R_{\text{IO}}$   | $10^9$    |      |      | $\Omega$         |
| Rated impulse voltage                                   |                                                                                                        | $V_{\text{IOTM}}$ |           |      | 6    | kV               |
| Max. working voltages                                   | Recurring peak voltage                                                                                 | $V_{\text{IORM}}$ | 850       |      |      | V                |
| Forward current                                         |                                                                                                        | $I_F$             |           |      | 130  | mA               |
| Power dissipation                                       |                                                                                                        | $P_{\text{diss}}$ |           |      | 265  | mW               |
| Safety temperature                                      |                                                                                                        | $T_{\text{si}}$   |           |      | 150  | $^\circ\text{C}$ |
| Creepage distance                                       |                                                                                                        |                   |           |      | 7.6  | 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.

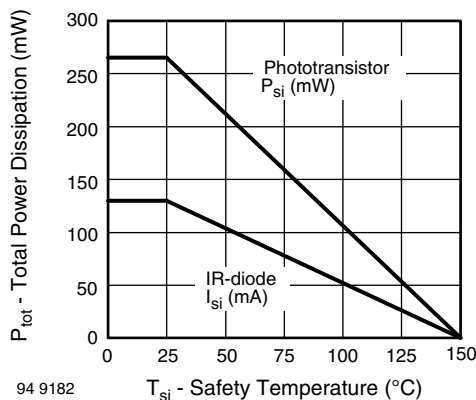


Fig. 1 - Derating Diagram

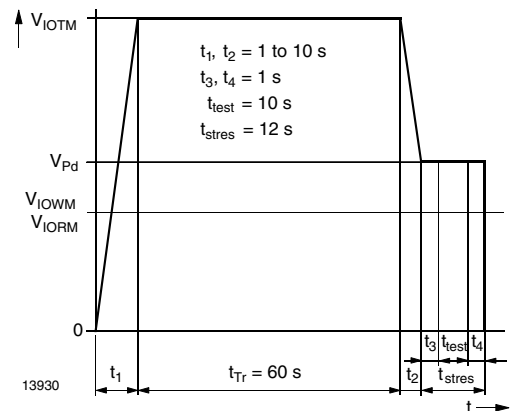


Fig. 2 - Test Pulse Diagram for Sample Test acc. to  
DIN EN 60747-5-2; IEC60747-5-5

| SWITCHING CHARACTERISTICS |                                                                                          |           |      |      |      |               |
|---------------------------|------------------------------------------------------------------------------------------|-----------|------|------|------|---------------|
| PARAMETER                 | TEST CONDITION                                                                           | SYMBOL    | MIN. | TYP. | MAX. | UNIT          |
| Delay time                | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_d$     |      | 3    |      | $\mu\text{s}$ |
| Rise time                 | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_r$     |      | 3    |      | $\mu\text{s}$ |
| Fall time                 | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_f$     |      | 4.7  |      | $\mu\text{s}$ |
| Storage time              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_s$     |      | 0.3  |      | $\mu\text{s}$ |
| Turn-on time              | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_{on}$  |      | 6    |      | $\mu\text{s}$ |
| Turn-off time             | $V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ ,<br>(see figure 3)       | $t_{off}$ |      | 5    |      | $\mu\text{s}$ |
| Turn-on time              | $V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ ,<br>(see figure 4) | $t_{on}$  |      | 9    |      | $\mu\text{s}$ |
| Turn-off time             | $V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ ,<br>(see figure 4) | $t_{off}$ |      | 10   |      | $\mu\text{s}$ |

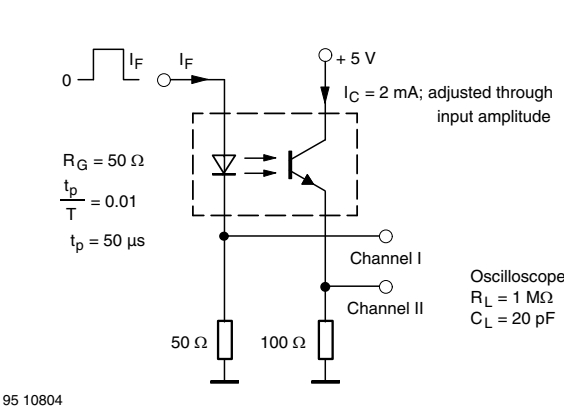


Fig. 3 - Test Circuit, Non-Saturated Operation

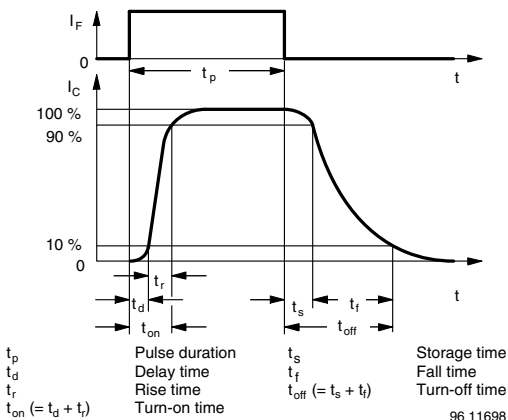


Fig. 5 - Switching Times

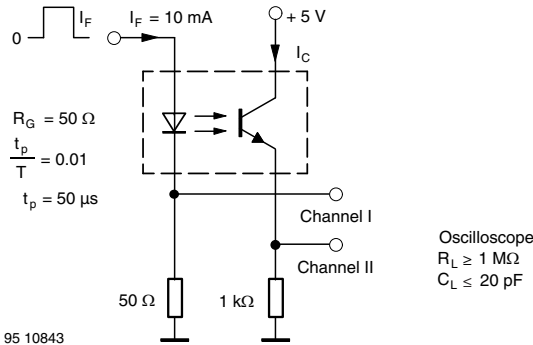


Fig. 4 - Test Circuit, Saturated Operation

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

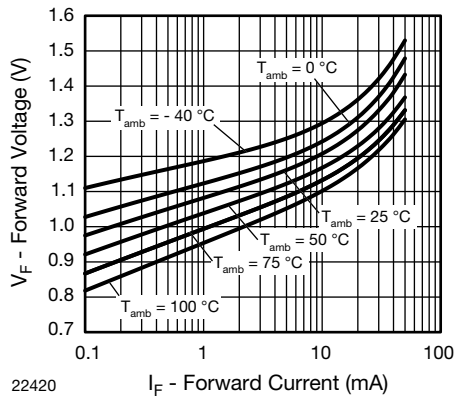


Fig. 6 - Forward Voltage vs. Forward Current

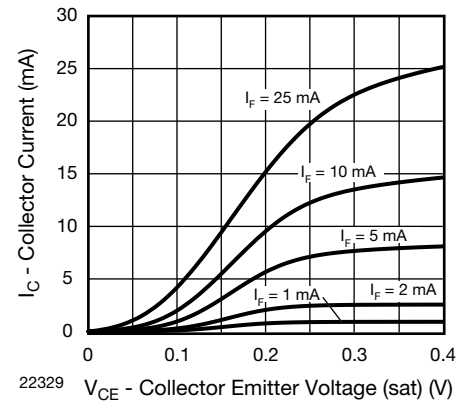


Fig. 9 - Collector Current vs. Collector Emitter Voltage (sat)

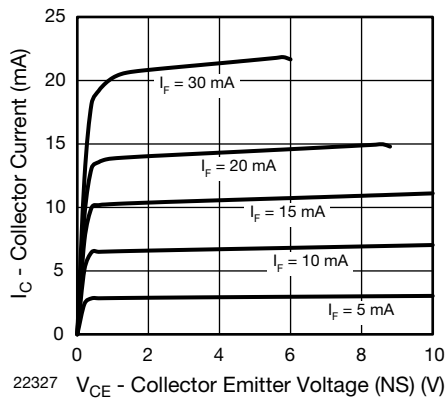


Fig. 7 - Collector Current vs. Collector Emitter Voltage (NS)

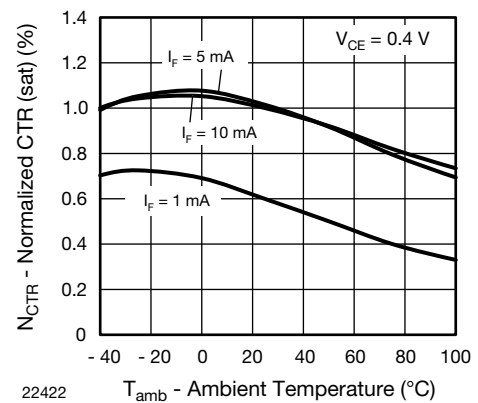


Fig. 10 - Normalized CTR (sat) vs. Ambient Temperature

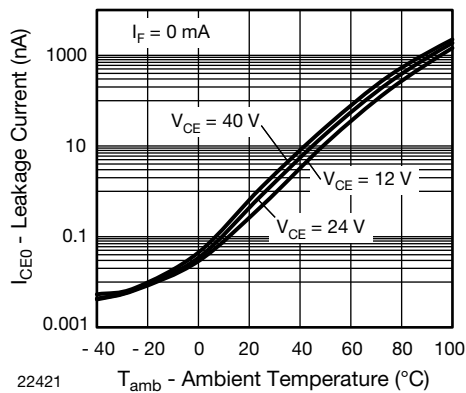


Fig. 8 - Leakage Current vs. Ambient Temperature

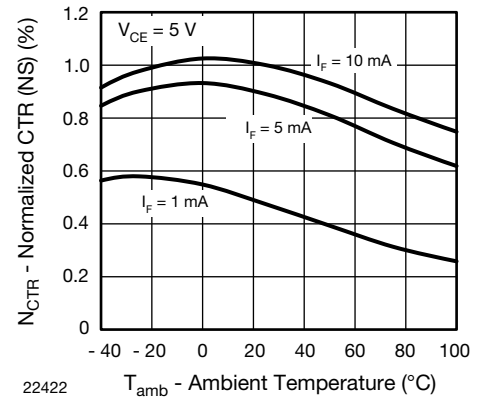


Fig. 11 - Normalized CTR (NS) vs. Ambient Temperature

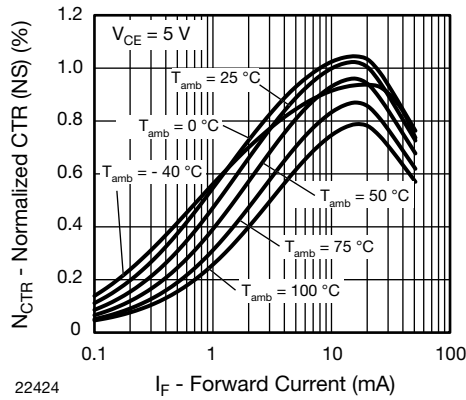


Fig. 12 - Normalized CTR (NS) vs. Forward Current

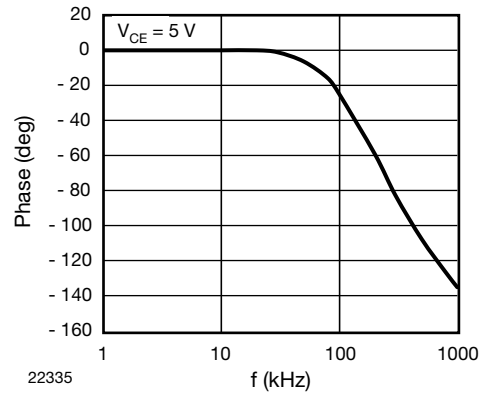


Fig. 15 -  $F_{CTR}$  vs. Phase Angle (kHz)

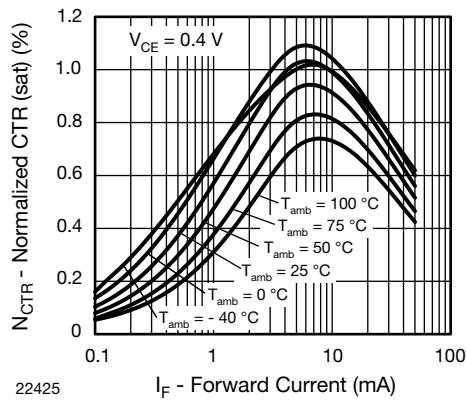


Fig. 13 - Normalized CTR (sat) vs. Forward Current

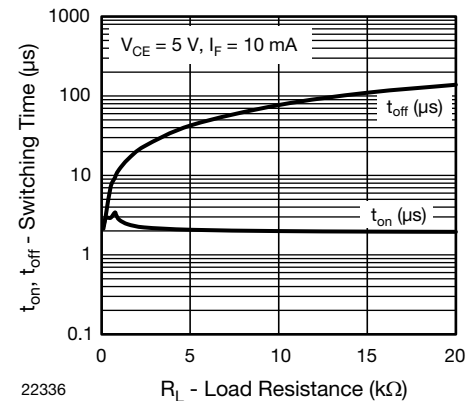


Fig. 16 - Switching Time vs. Load Resistance

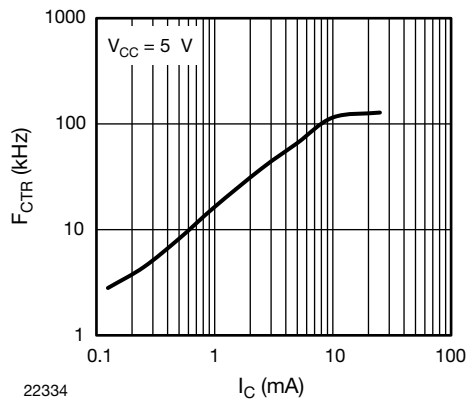
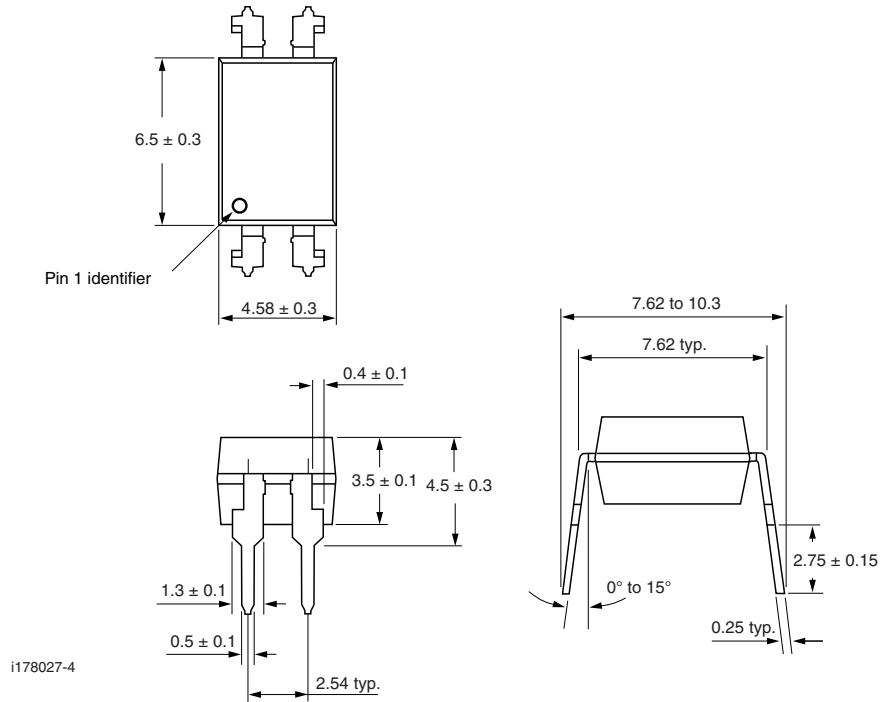
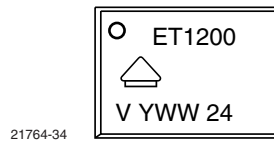


Fig. 14 -  $F_{CTR}$  vs.  $I_C$  (sat) (mA)

## PACKAGE DIMENSIONS in millimeters



## PACKAGE MARKING



### Note

- VDE logo is only printed on option 1 parts. Option information is not marked on the part.



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