

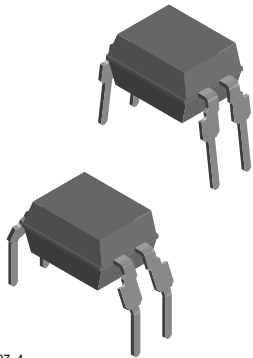


**THE DATASHEET OF  
TCET1109G**

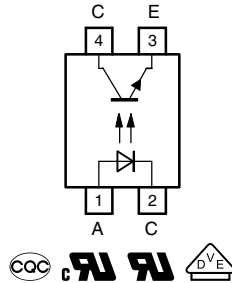




## Optocoupler, Phototransistor Output, High Temperature



17197\_4



### FEATURES

- High common mode rejection
- Low temperature coefficient of CTR
- CTR offered in 7 groups
- Reinforced isolation provides circuit protection against electrical shock (safety class II)
- Isolation materials according to UL 94 V-0
- Pollution degree 2 (DIN / VDE 0110 / resp. IEC 60664)
- Climatic classification 55 / 100 / 21 (IEC 60068 part 1)
- Rated impulse voltage (transient overvoltage)  $V_{IOTM} = 6 \text{ kV}_{peak}$
- Isolation test voltage (partial discharge test voltage)  $V_{pd} = 1.6 \text{ kV}$
- Rated isolation voltage (RMS includes DC)  $V_{IOWM} = 600 \text{ V}_{RMS}$
- Rated recurring peak voltage (repetitive)  $V_{IORM} = 848 \text{ V}_{peak}$
- Creepage current resistance according to VDE 0303 / IEC 60112 comparative tracking index: CTI  $\geq 175$
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



RoHS COMPLIANT

### LINKS TO ADDITIONAL RESOURCES



### DESCRIPTION

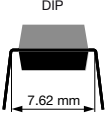
The TCET110. consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-lead plastic dual inline package.

### AGENCY APPROVALS

- [UL 1577](#)
- [cUL 1577](#)
- [DIN EN 60747-5-5 \(VDE 0884-5\)](#)
- [BSI: EN 62368-1:2014](#)
- [CQC GB4943.1-2011](#)
- [CQC GB8898-2011](#)

### APPLICATIONS

- Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):
- For application class I to IV at mains voltage  $\leq 300 \text{ V}$
  - For application class I to III at mains voltage  $\leq 600 \text{ V}$  according to DIN EN 60747-5-5 (VDE 0884), suitable for:
    - Switch-mode power supplies
    - Line receiver
    - Computer peripheral interface
    - Microprocessor system interface

ORDERING INFORMATION															
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: 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;">E</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;">1</div> <div style="border: 1px solid black; padding: 2px 5px;">0</div> <div style="border: 1px solid black; padding: 2px 5px;">#</div> </div> <div style="text-align: center;">#</div> </div>							PART NUMBER			LEAD FORM					
AGENCY CERTIFIED / PACKAGE	CTR (%)														
	10 mA														
UL, cUL, VDE, BSI, CQC	50 to 600	40 to 80	63 to 125	100 to 200	160 to 320	100 to 300	80 to 160	130 to 260	200 to 400						
DIP-4	TCET1100	-	TCET1102	TCET1103	-	TCET1106	TCET1107	TCET1108	TCET1109						
DIP-4, 400 mil	TCET1100G	TCET1101G	TCET1102G	TCET1103G	TCET1104G	TCET1106G	TCET1107G	TCET1108G	TCET1109G						

### Note

- G = lead form 10.16 mm; G is not marked on the body



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
<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
<b>COUPLER</b>				
Isolation test voltage (RMS)	t = 1 min	V <sub>ISO</sub>	5000	V <sub>RMS</sub>
Operating ambient temperature range		T <sub>amb</sub>	-40 to +100	°C
Storage temperature range		T <sub>stg</sub>	-55 to +125	°C
Soldering temperature <sup>(1)</sup>	2 mm from case, ≤ 10 s	T <sub>slid</sub>	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
- <sup>(1)</sup> Refer to wave profile for soldering conditions for through hole devices

THERMAL CHARACTERISTICS				
PARAMETER	SYMBOL	VALUE	UNIT	
LED power dissipation	P <sub>diss</sub>	100	mW	
Output power dissipation	P <sub>diss</sub>	150	mW	
Maximum LED junction temperature	T <sub>jmax.</sub>	125	°C	
Maximum output die junction temperature	T <sub>jmax.</sub>	125	°C	
Thermal resistance, junction emitter to board	θ <sub>EB</sub>	173	°C/W	
Thermal resistance, junction emitter to case	θ <sub>EC</sub>	149	°C/W	
Thermal resistance, junction detector to board	θ <sub>DB</sub>	111	°C/W	
Thermal resistance, junction detector to case	θ <sub>DC</sub>	127	°C/W	
Thermal resistance, junction emitter to junction detector	θ <sub>ED</sub>	173	°C/W	
Thermal resistance, board to ambient <sup>(1)</sup>	θ <sub>BA</sub>	197	°C/W	
Thermal resistance, case to ambient <sup>(1)</sup>	θ <sub>CA</sub>	4041	°C/W	

**Notes**

- The thermal model is represented in the thermal network below. Each resistance value given in this model can be used to calculate the temperatures at each node for a given operating condition. The thermal resistance from board to ambient will be dependent on the type of PCB, layout and thickness of copper traces. For a detailed explanation of the thermal model, please reference Vishay’s “Thermal Characteristics of Optocouplers” application note
- <sup>(1)</sup> For 2 layer FR4 board (4" x 3" x 0.062")



<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	$V_R = 0, f = 1\text{ MHz}$	$C_j$	-	50	-	pF
<b>OUTPUT</b>						
Collector emitter voltage	$I_C = 1\text{ mA}$	$V_{CE0}$	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	$f = 1\text{ MHz}$	$C_k$	-	0.3	-	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>							
PARAMETER	TEST CONDITION	PART	SYMBOL	MIN.	TYP.	MAX.	UNIT
$I_C/I_F$	$V_{CE} = 5\text{ V}, I_F = 1\text{ mA}$	TCET1101G	CTR	13	30	-	%
		TCET1102, TCET1102G	CTR	22	45	-	%
		TCET1103, TCET1103G	CTR	34	70	-	%
		TCET1104G	CTR	56	90	-	%
	$V_{CE} = 5\text{ V}, I_F = 5\text{ mA}$	TCET1100, TCET1100G	CTR	50	-	600	%
		TCET1106, TCET1106G	CTR	100	-	300	%
		TCET1107, TCET1107G	CTR	80	-	160	%
		TCET1108, TCET1108G	CTR	130	-	260	%
		TCET1109, TCET1109G	CTR	200	-	400	%
	$V_{CE} = 5\text{ V}, I_F = 10\text{ mA}$	TCET1101, TCET1101G	CTR	40	-	80	%
		TCET1102, TCET1102G	CTR	63	-	125	%
		TCET1103, TCET1103G	CTR	100	-	200	%
		TCET1104, TCET1104G	CTR	160	-	320	%

MAXIMUM SAFETY RATINGS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
<b>INPUT</b>						
Forward current		$I_F$	-	-	130	mA
<b>OUTPUT</b>						
Power dissipation		$P_{diss}$	-	-	265	mW
<b>COUPLER</b>						
Rated impulse voltage		$V_{IOTM}$	-	-	6	kV
Safety temperature		$T_{si}$	-	-	150	°C

**Note**

- According to DIN EN 60747-5-5 (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

INSULATION RATED PARAMETERS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Partial discharge test voltage - routine test	100 %, $t_{test} = 1$ s	$V_{pd}$	1.6	-	-	kV
Partial discharge test voltage - lot test (sample test)	$t_{Tr} = 60$ s, $t_{test} = 10$ s, (see figure 2)	$V_{IOTM}$	6	-	-	kV
		$V_{pd}$	1.3	-	-	kV
Insulation resistance	$V_{IO} = 500$ V	$R_{IO}$	$10^{12}$	-	-	$\Omega$
	$V_{IO} = 500$ V, $T_{amb} = 100$ °C	$R_{IO}$	$10^{11}$	-	-	$\Omega$
	$V_{IO} = 500$ V, $T_{amb} = 150$ °C (construction test only)	$R_{IO}$	$10^9$	-	-	$\Omega$

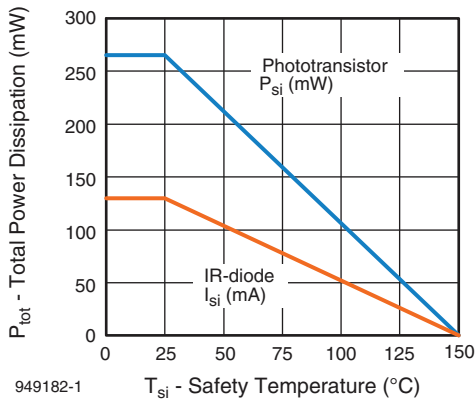


Fig. 1 - Derating Diagram

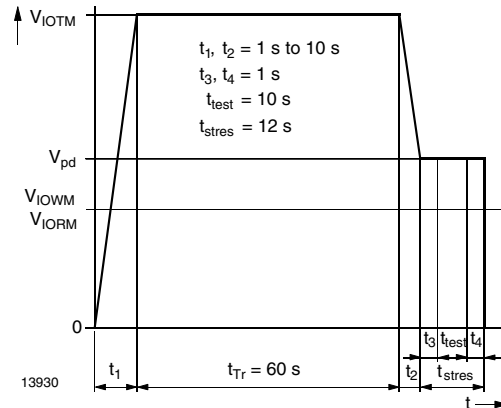


Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-5 / DIN EN 60747-; IEC 60747

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

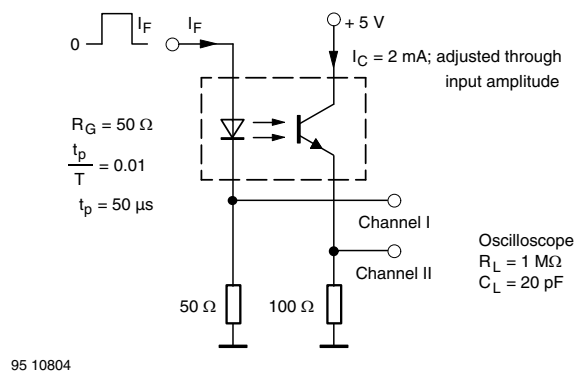


Fig. 3 - Test Circuit, Non-Saturated Operation

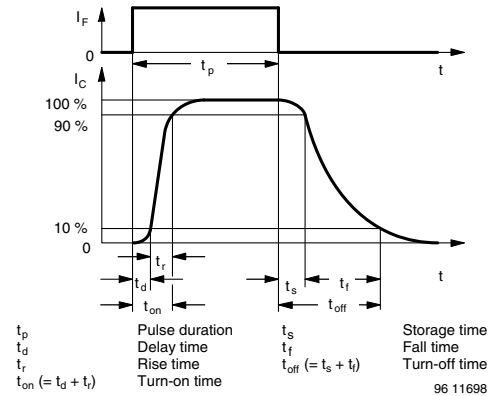


Fig. 5 - Switching Times

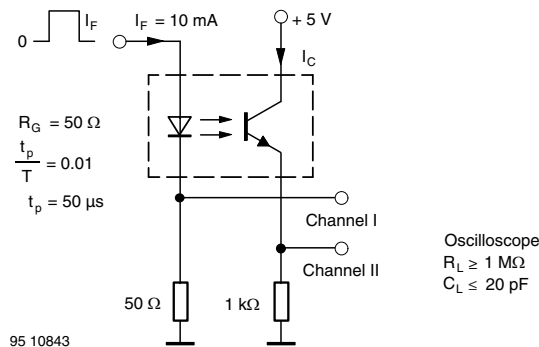


Fig. 4 - Test Circuit, Saturated Operation



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

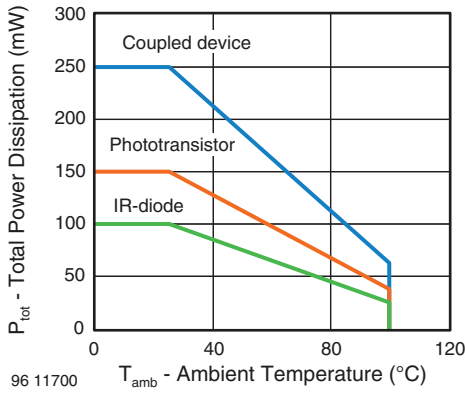


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

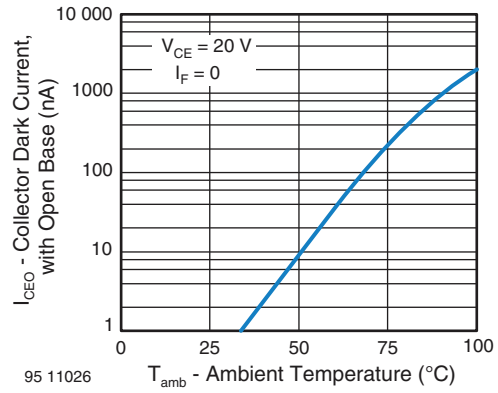


Fig. 9 - Collector Dark Current vs. Ambient Temperature

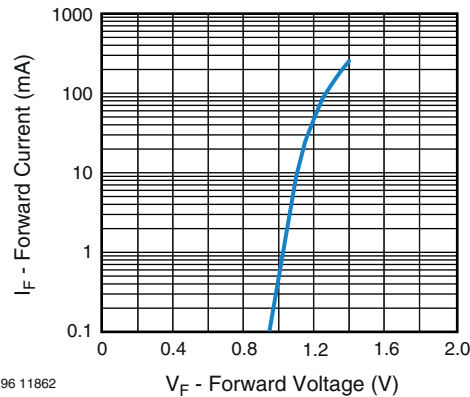


Fig. 7 - Forward Current vs. Forward Voltage

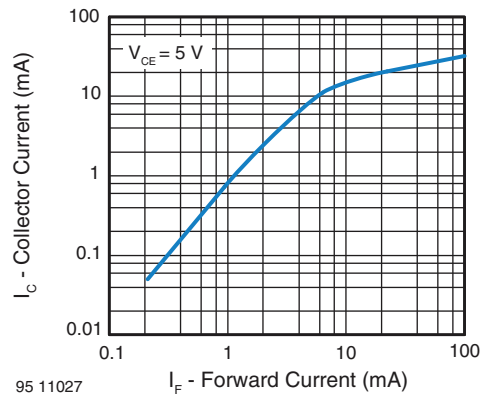


Fig. 10 - Collector Current vs. Forward Current

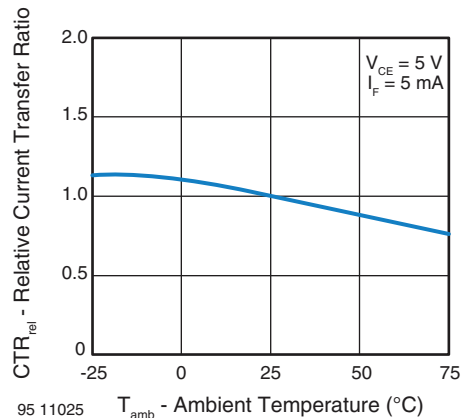


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

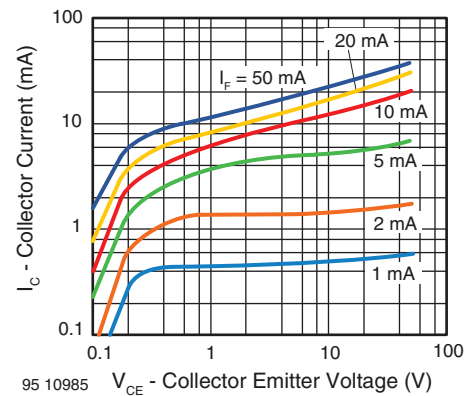


Fig. 11 - Collector Current vs. Collector Emitter Voltage

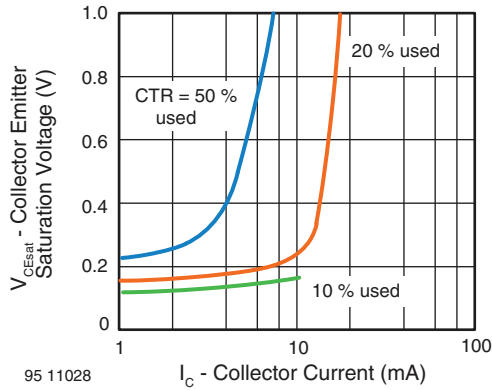


Fig. 12 - Collector Emitter Saturation Voltage vs. Collector Current

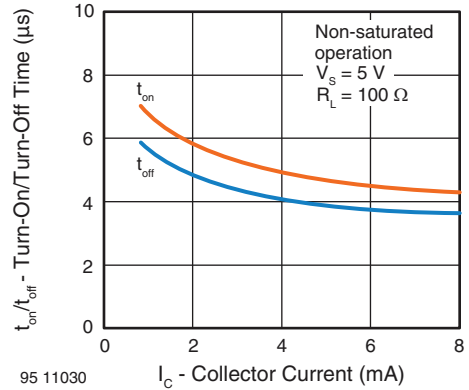


Fig. 14 - Turn-On / Off Time vs. Collector Current

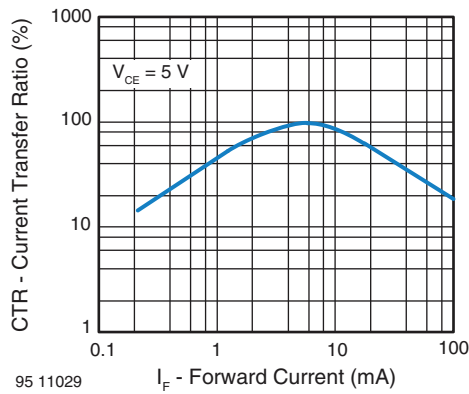


Fig. 13 - Current Transfer Ratio vs. Forward Current

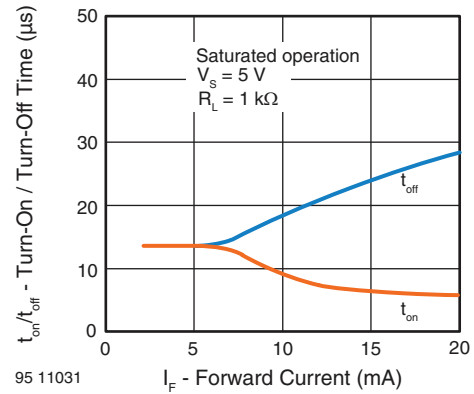
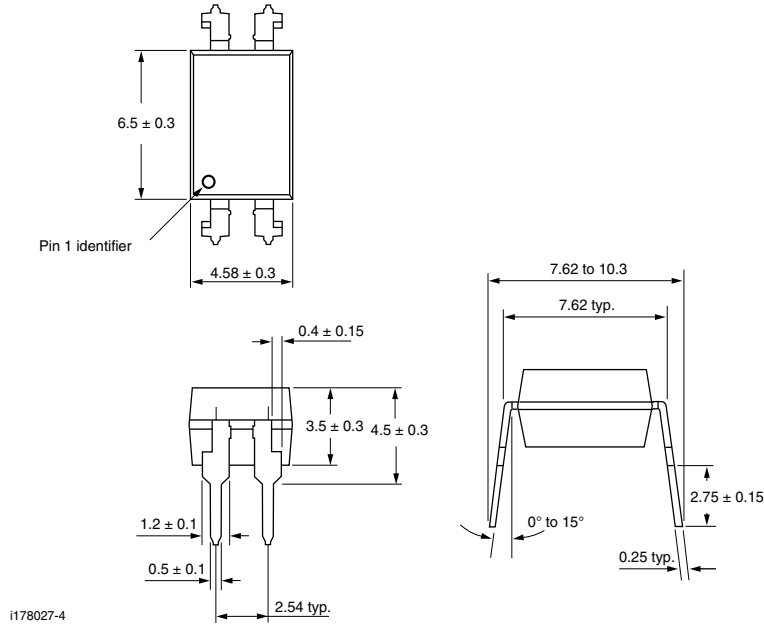


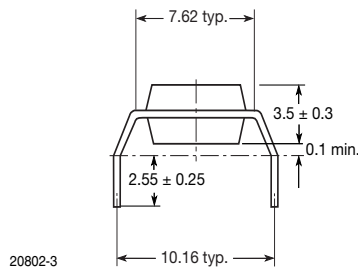
Fig. 15 - Turn-On / Off Time vs. Forward Current



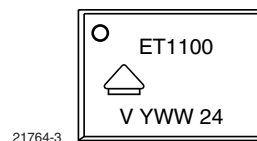
## PACKAGE DIMENSIONS in millimeters



### TCET1100G type



## PACKAGE MARKING





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