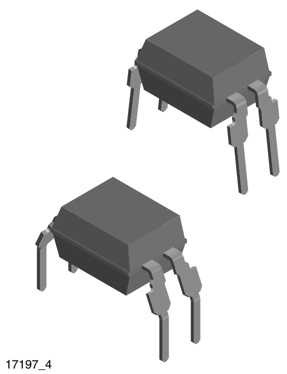
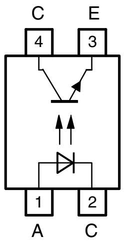
Optocoupler, Phototransistor Output, High Temperature





LINKS TO ADDITIONAL RESOURCES

Related Documents

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

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 kV_{peak}
- Isolation test voltage (partial discharge test voltage) V_{pd} = 1.6 kV
- Rated isolation voltage (RMS includes DC) V_{IOWM} = 600 V_{RMS}
- Rated recurring peak voltage (repetitive) V_{IORM} = 848 V_{peak}
- Creepage current resistance according to VDE 0303 / IEC 60112 comparative tracking index: CTI ≥ 175
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

Pb-free

e3

RoHS
COMPLIANT

APPLICATIONS

Circuits for safe protective separation against electrical shock according to safety class II (reinforced isolation):

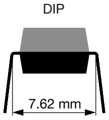
- For application class I to IV at mains voltage ≤ 300 V
- For application class I to III at mains voltage ≤ 600 V according to DIN EN 60747-5-5 (VDE 0884), suitable for:
  - Switch-mode power supplies
  - Line receiver
  - Computer peripheral interface
  - Microprocessor system interface

ORDERING INFORMATION

T	C	E	T	1	1	0	#	#

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

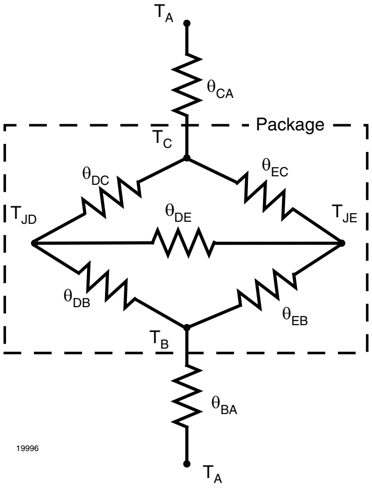
- G = lead form 10.16 mm; G is not marked on the body

ABSOLUTE MAXIMUM RATINGS (T_{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
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
COUPLER				
Isolation test voltage (RMS)	t = 1 min	V_{ISO}	5000	V_{RMS}
Operating ambient temperature range		T_{amb}	-40 to +100	°C
Storage temperature range		T_{stg}	-55 to +125	°C
Soldering temperature (1)	2 mm from case, ≤ 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 wave profile for soldering conditions for through hole devices

THERMAL CHARACTERISTICS				
PARAMETER	**SYMBOL**	**VALUE**	**UNIT**	
LED power dissipation	P_{diss}	100	mW	
Output power dissipation	P_{diss}	150	mW	
Maximum LED junction temperature	$T_{jmax.}$	125	°C	
Maximum output die junction temperature	$T_{jmax.}$	125	°C	
Thermal resistance, junction emitter to board	θ_{EB}	173	°C/W	
Thermal resistance, junction emitter to case	θ_{EC}	149	°C/W	
Thermal resistance, junction detector to board	θ_{DB}	111	°C/W	
Thermal resistance, junction detector to case	θ_{DC}	127	°C/W	
Thermal resistance, junction emitter to junction detector	θ_{ED}	173	°C/W	
Thermal resistance, board to ambient (1)	θ_{BA}	197	°C/W	
Thermal resistance, case to ambient (1)	θ_{CA}	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

(1) For 2 layer FR4 board (4" x 3" x 0.062")

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, 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 cut-off current	V_{CE} = 20 V, I_F = 0 A, E = 0	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							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	V_{CE} = 5 V, I_F = 1 mA	TCET1101G	CTR	13	30	-	%
		TCET1102, TCET1102G	CTR	22	45	-	%
		TCET1103, TCET1103G	CTR	34	70	-	%
		TCET1104G	CTR	56	90	-	%
	V_{CE} = 5 V, I_F = 5 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 V, I_F = 10 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**
INPUT						
Forward current		I_F	-	-	130	mA
OUTPUT						
Power dissipation		P_{diss}	-	-	265	mW
COUPLER						
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}	-	-	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	10^{11}	-	-	Ω
	V_{IO} = 500 V, T_{amb} = 150 °C (construction test only)	R_{IO}	10^9	-	-	Ω

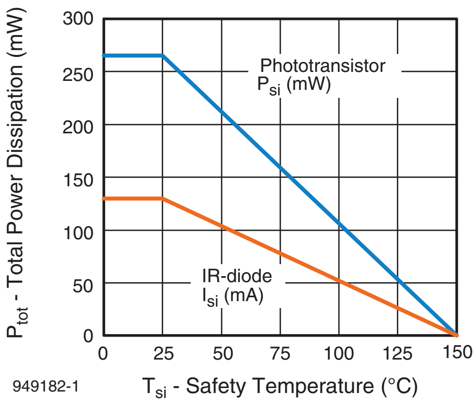


Fig. 1 - Derating Diagram

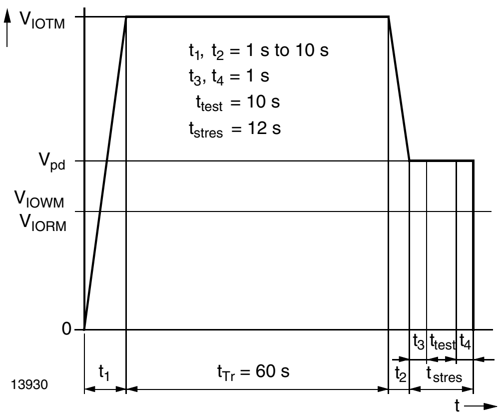


Fig. 2 - Test Pulse Diagram for Sample Test According to DIN EN 60747-5-5 / DIN EN 60747-; IEC 60747

SWITCHING CHARACTERISTICS

PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Delay time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 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
Turn-on time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 3)	t_{on}	-	6	-	μs
Storage time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 3)	t_s	-	0.3	-	μs
Fall time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see Fig. 3)	t_f	-	4.7	-	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

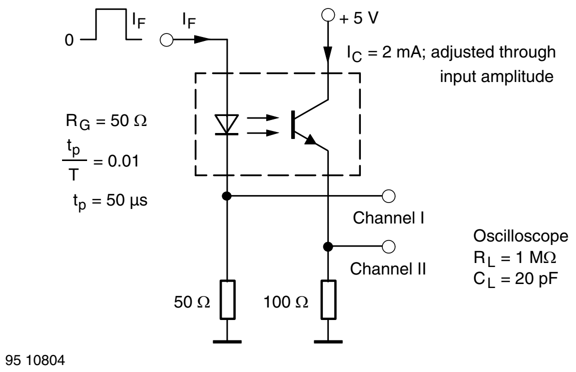


Fig. 3 - Test Circuit, Non-Saturated Operation

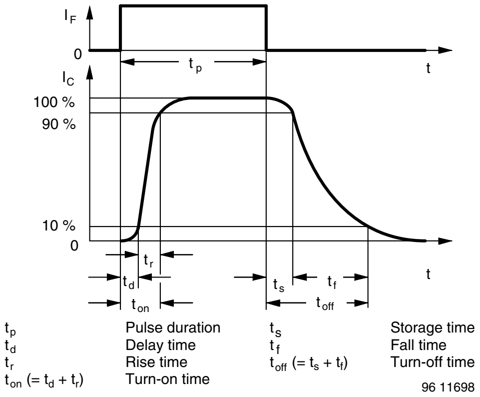


Fig. 5 - Switching Times

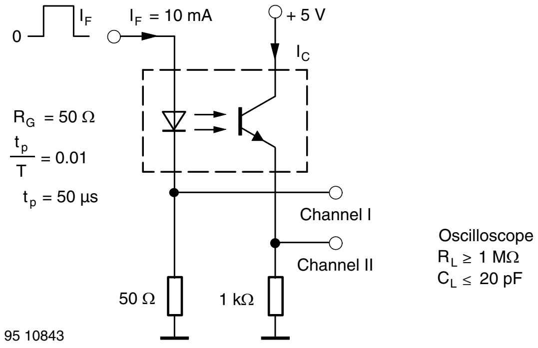


Fig. 4 - Test Circuit, Saturated Operation

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

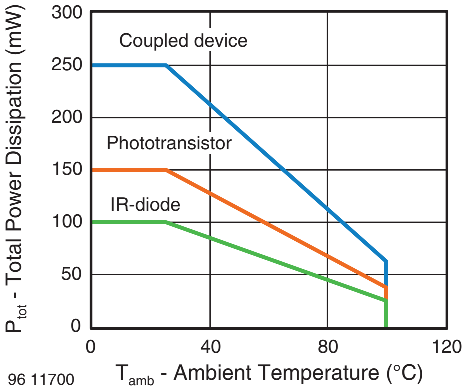


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

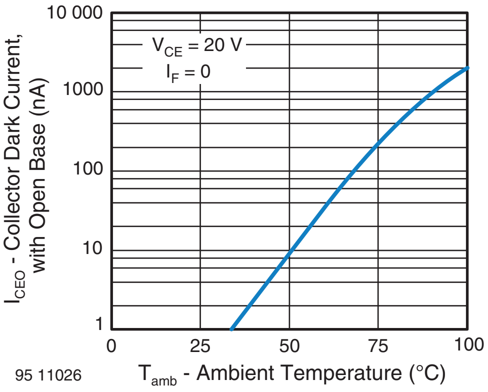


Fig. 9 - Collector Dark Current vs. Ambient Temperature

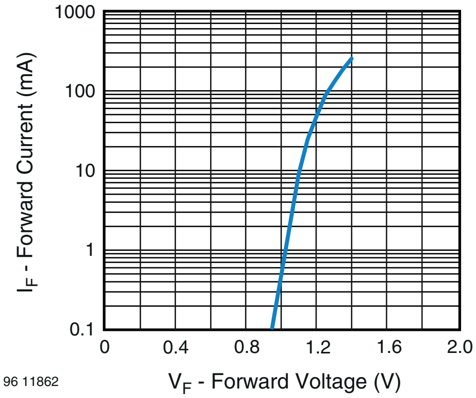


Fig. 7 - Forward Current vs. Forward Voltage

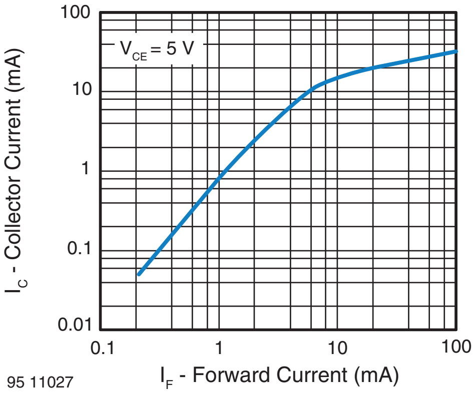


Fig. 10 - Collector Current vs. Forward Current

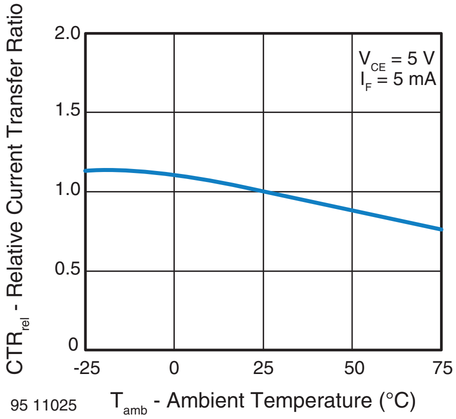


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

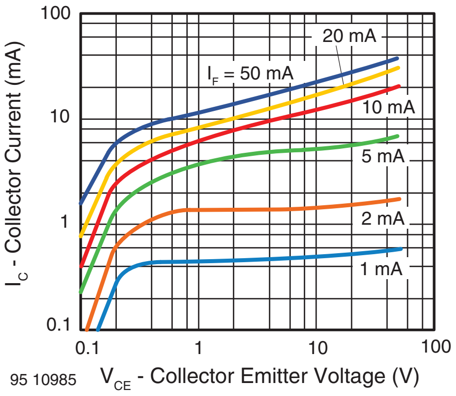


Fig. 11 - Collector Current vs. Collector Emitter Voltage

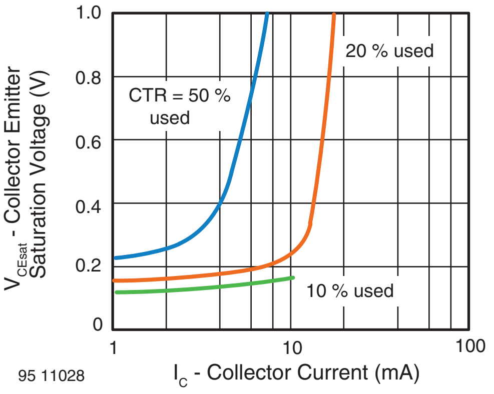


Fig. 12 - Collector Emitter Saturation Voltage vs. Collector Current

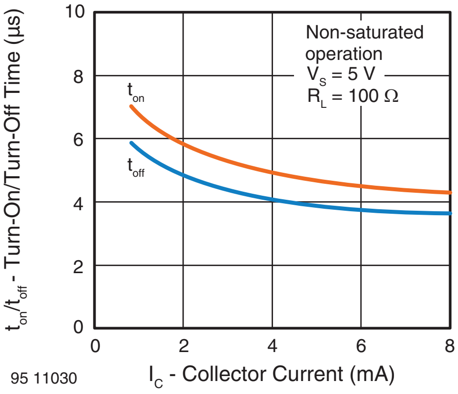


Fig. 14 - Turn-On / Off Time vs. Collector Current

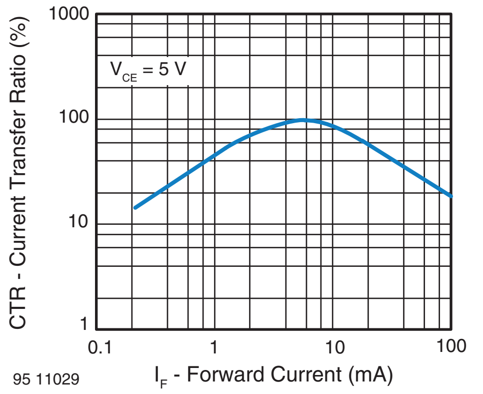


Fig. 13 - Current Transfer Ratio vs. Forward Current

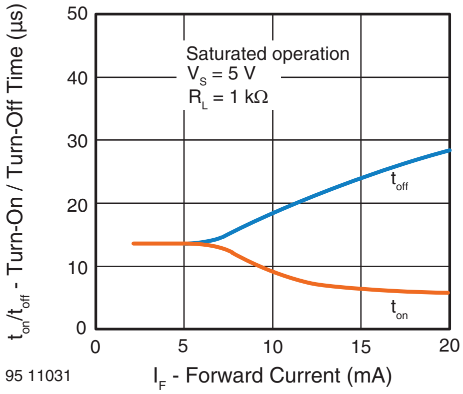
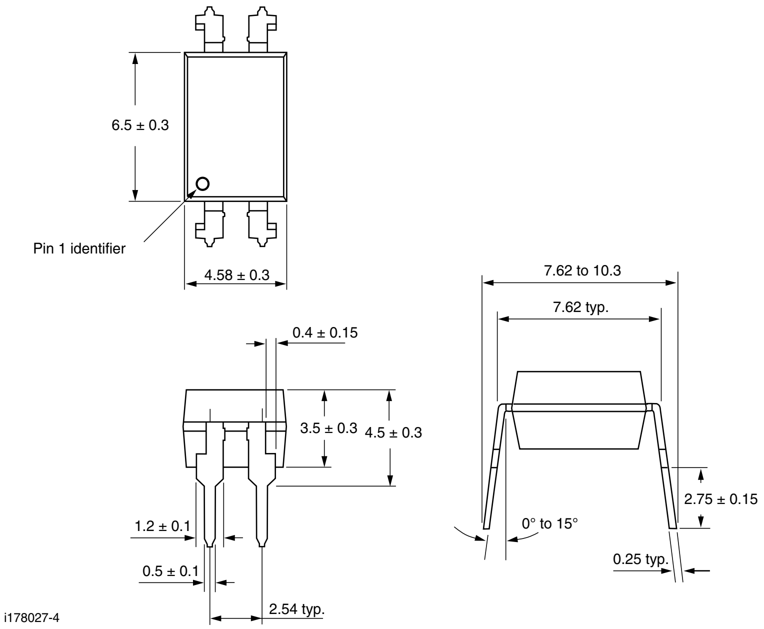
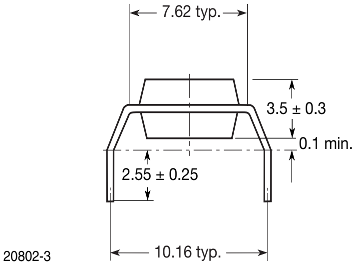


Fig. 15 - Turn-On / Off Time vs. Forward Current

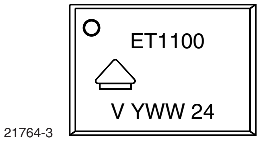
PACKAGE DIMENSIONS in millimeters



TCET1100G type



PACKAGE MARKING



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