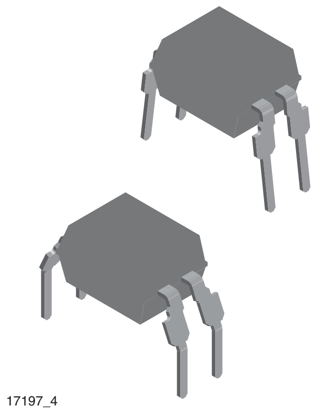
Optocoupler, Phototransistor Output, High Temperature, 110 °C, Rated



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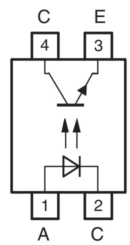


DESCRIPTION

The TCET1110, TCET1110G consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4 pin plastic dual inline package.

APPLICATIONS

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

- for appl. class I to IV at mains voltage ≤ 300 V
- for appl. class I to III at mains voltage ≤ 600 V according to DIN EN 60747-5-2 (VDE 0884), suitable for:

- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface

FEATURES

- CTR offered in 9 groups
- Isolation materials according to UL 94 V-O
- Pollution degree 2 (DIN/VDE 0110/resp. IEC 60664)
- Climatic classification 55/100/21 (IEC 60068 part 1)
- Special construction: therefore, extra low coupling capacity of typical 0.2 pF, high common mode rejection
- Low temperature coefficient of CTR
- Temperature range - 40 °C to + 110 °C
- 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} = 850 V_{peak}
- Creepage current resistance according to VDE 0303/ IEC 60112 comparative tracking index: CTI ≥ 175
- Thickness through insulation ≥ 4 mm
- External creepage distance > 8 mm
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

AGENCY APPROVALS

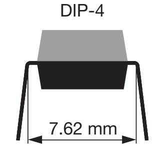
- UL1577, file no. E52744, double protection
- BSI: EN 60065:2002, EN 60950-1:2006
- DIN EN 60747-5-2 (VDE 0884)
- FIMKO

ORDERING INFORMATION

T	C	E	T	1	1	1	#	-	#

PART NUMBER (T C E T 1 1 1 #) — PACKAGE OPTION (#)

DIP-4



AGENCY CERTIFIED/PACKAGE	CTR (%)			
	5 mA	10 mA		
UL, VDE, BSI, FIMKO	**50 to 600**	**63 to 125**	**100 to 200**	**160 to 320**
DIP-4	TCET1110	TCET1112	TCET1113	TCET1114
DIP-4, 400 mil	-	-	TCET1113G	TCET1114G

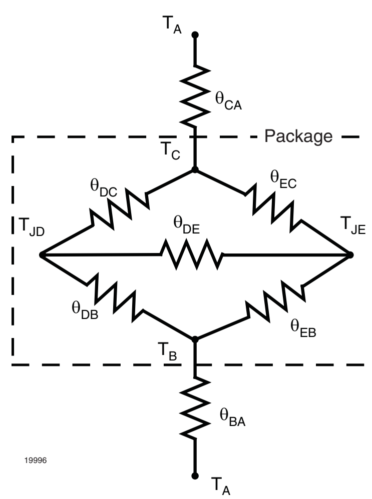
ABSOLUTE MAXIMUM RATINGS (T_{amb} = 25 °C, unless otherwise specified)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6	V
Forward current		I_F	60	mA
Forward surge current	$t_p \leq 10$ μs	I_{FSM}	1.5	A
OUTPUT				
Collector emitter voltage		V_{CEO}	70	V
Emitter 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 s	V_{ISO}	5000	V_{RMS}
Operating ambient temperature range		T_{amb}	- 40 to + 110	°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 (DIP).

THERMAL CHARACTERISTICS			
PARAMETER	**SYMBOL**	**VALUE**	**UNIT**
LED power dissipation	P_{diss}	70	mW
Output power dissipation	P_{diss}	70	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	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		0.6		pF

Note

(1) 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 = 1 mA	TCET1112, TCET1112G	CTR	22	45		%
		TCET1113, TCET1113G	CTR	34	70		%
		TCET1114, TCET1114G	CTR	56	90		%
	V_{CE} = 5 V, I_F = 5 mA	TCET1110, TCET1110G	CTR	50		600	%
	V_{CE} = 5 V, I_F = 10 mA	TCET1112, TCET1112G	CTR	63		125	%
		TCET1113, TCET1113G	CTR	100		200	%
		TCET1114, TCET1114G	CTR	160		320	%

SAFETY AND 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}	8			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
Forward current		I_{si}			130	mA
Power dissipation		P_{so}			265	mW
Rated impulse voltage		V_{IOTM}			6	kV
Safety temperature		T_{si}			150	°C

Note

- According to DIN EN 60747-5-2 (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.

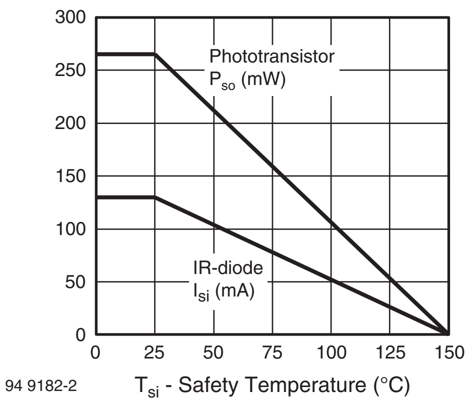


Fig. 1 - Derating Diagram

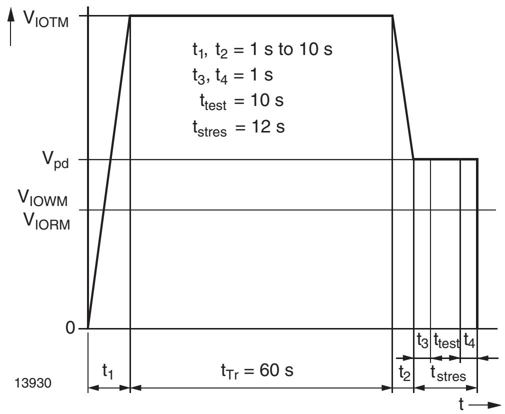


Fig. 2 - Test Pulse Diagram for Sample Test according to DIN EN 60747-5-2 (VDE 0884)/IEC 60747-5-5

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 figure 3)	t_d		3		µs
Rise time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 3)	t_r		3		µs
Fall time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 3)	t_f		4.7		µs
Storage time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 3)	t_s		0.3		µs
Turn-on time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 3)	t_{on}		6		µs
Turn-off time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 3)	t_{off}		5		µs
Turn-on time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ, (see figure 4)	t_{on}		9		µs
Turn-off time	V_S = 5 V, I_F = 10 mA, R_L = 1 kΩ, (see figure 4)	t_{off}		10		µs

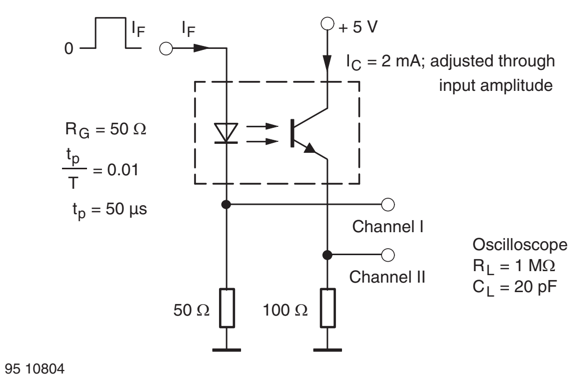


Fig. 3 - Test Circuit, Non-Saturated Operation

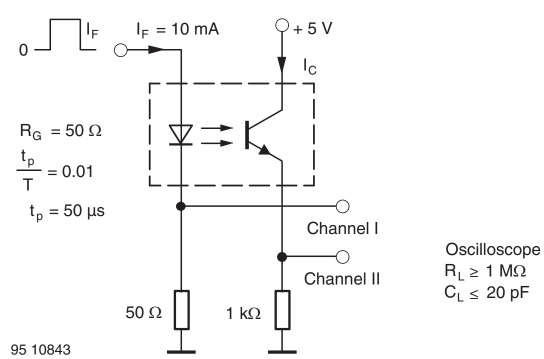


Fig. 4 - Test Circuit, Saturated Operation

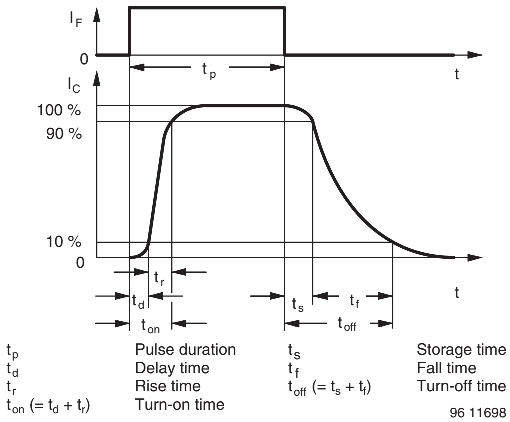


Fig. 5 - Switching Times

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

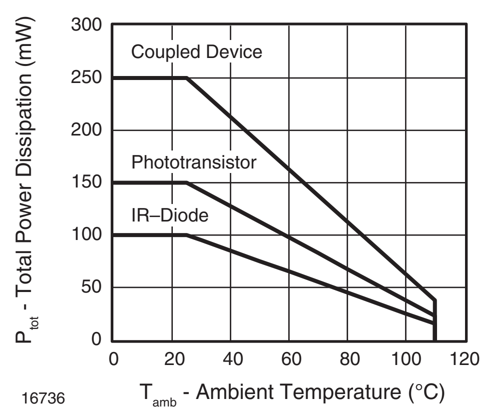


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

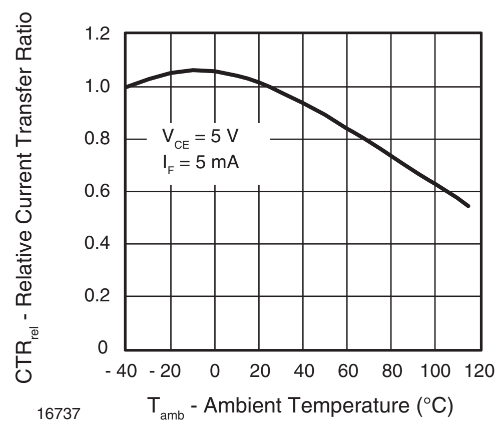


Fig. 8 - Relative Current Transfer Ratio vs. Ambient Temperature

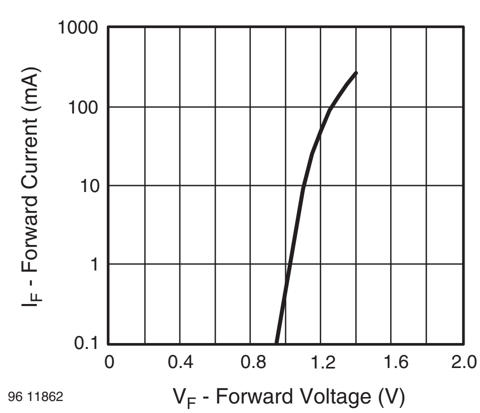


Fig. 7 - Forward Current vs. Forward Voltage

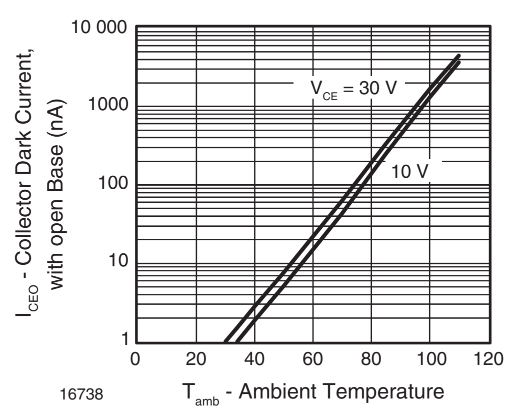


Fig. 9 - Collector Dark Current vs. Ambient Temperature

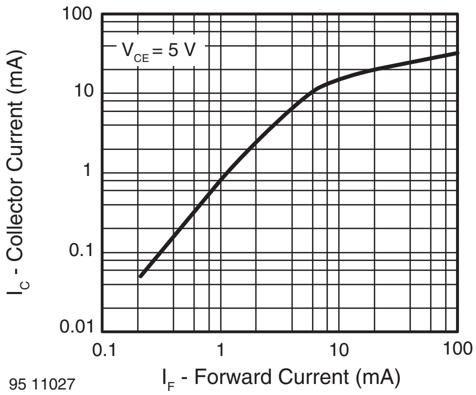


Fig. 10 - Collector Current vs. Forward Current

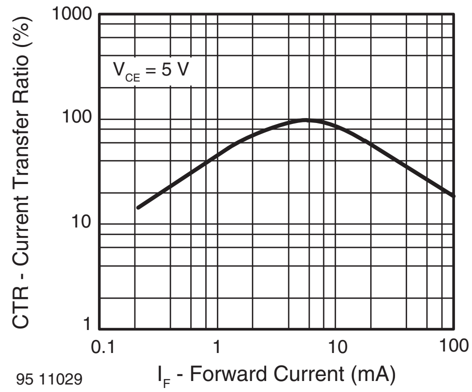


Fig. 13 - Current Transfer Ratio vs. Forward Current

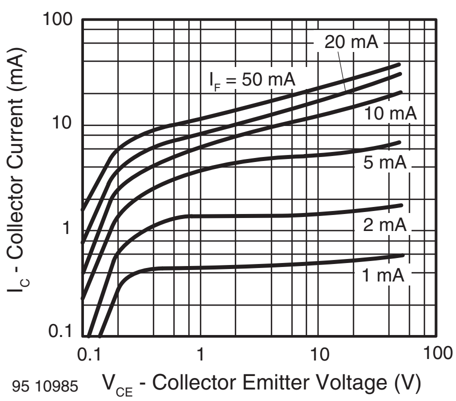


Fig. 11 - Collector Current vs. Collector Emitter Voltage

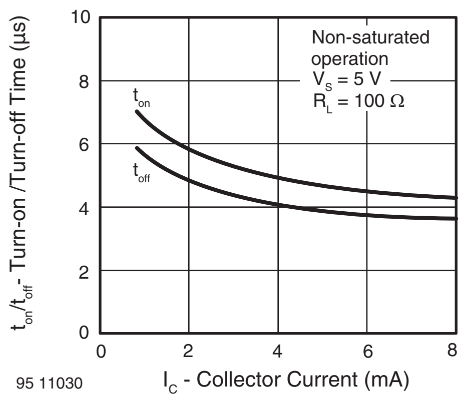


Fig. 14 - Turn-on/off Time vs. Collector Current

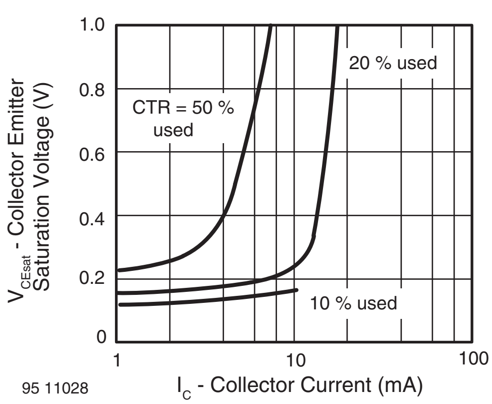


Fig. 12 - Collector Emitter Saturation Voltage vs. Collector Current

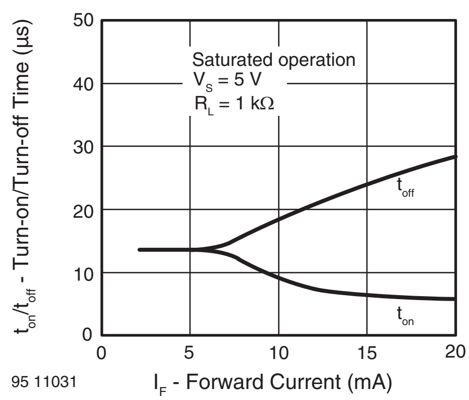
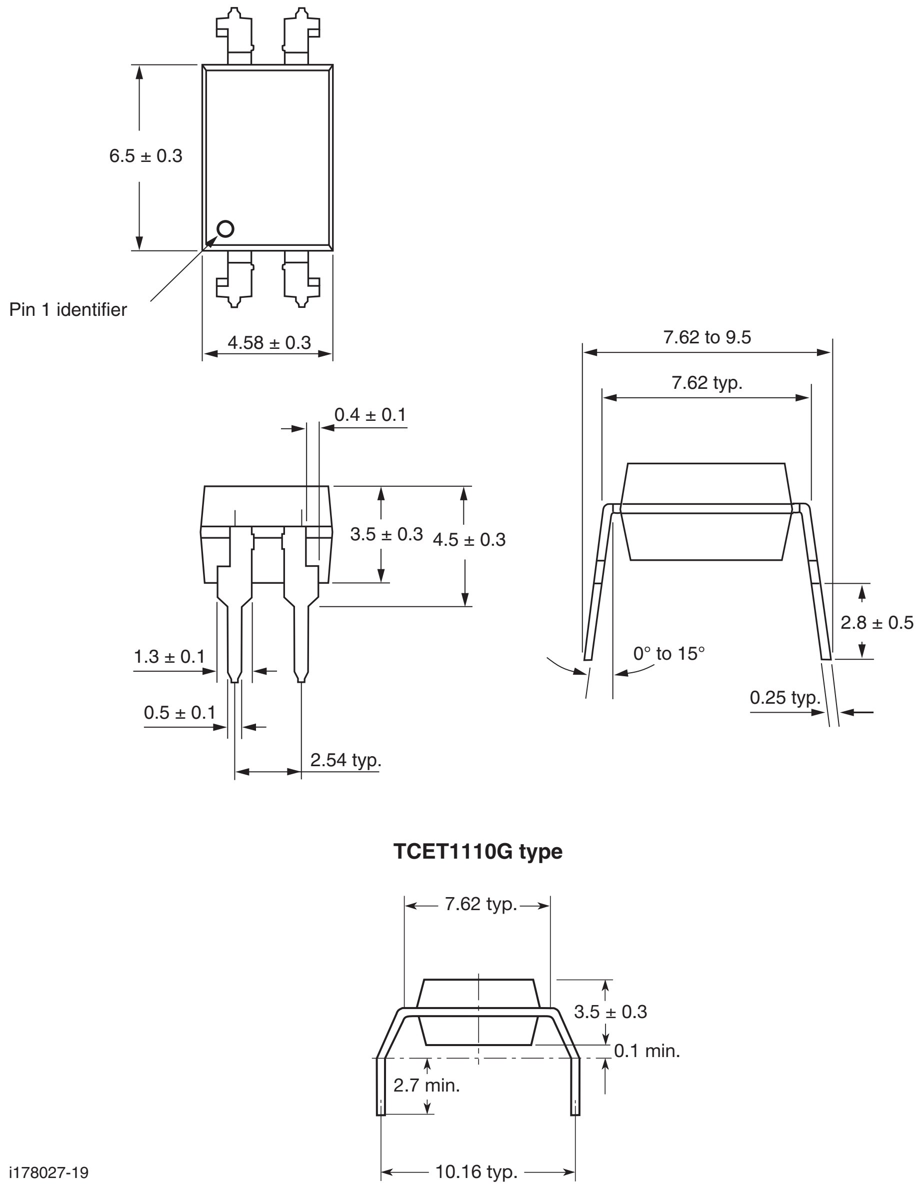
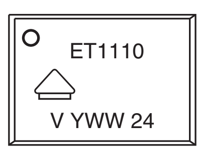


Fig. 15 - Turn-on/off Time vs. Forward Current

PACKAGE DIMENSIONS in millimeters



PACKAGE MARKING (example)



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