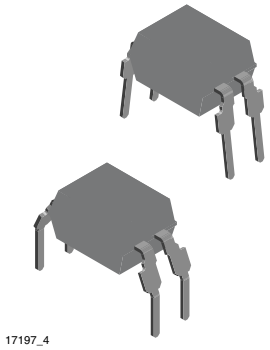
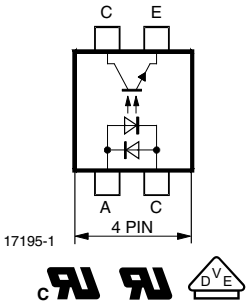
Optocoupler, Phototransistor Output, AC Input





DESCRIPTION

The TCET1600, TCET1600G consists of a phototransistor optically coupled to 2 gallium arsenide infrared-emitting diodes in a single (4 pin) 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 ≤ 400 V_{RMS})
- **VDE 0804**
  Telecommunication apparatus and data processing
- **IEC 60065**
  Safety for mains-operated electronic and related household apparatus
- **VDE 0700/IEC 335**
  Household equipment
- **VDE 0160**
  Electronic equipment for electrical power installation
- **VDE 0750/IEC 60601**
  Medical equipment

FEATURES

- Isolation materials according to UL94 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
- Rated impulse voltage (transient overvoltage) V_{IOTM} = 10 kV peak
- Isolation test voltage (partial discharge test voltage) V_{pd} = 1.6 kV peak
- Rated isolation voltage (RMS includes DC) V_{IOWM} = 600 V_{RMS}
- Rated recurring peak voltage (repetitive) V_{IORM} = 890 V_{peak}
- Thickness though insulation ≥ 0.75 mm
- Creepage current resistance according to VDE 0303/ IEC 60112 comparative tracking index: CTI ≥ 175
- Compliant to RoHS Directive 2002/95/EC and in accordance to WEEE 2002/96/EC

Pb-free

e3

RoHS COMPLIANT

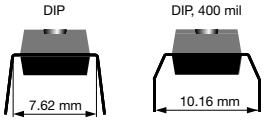
AGENCY APPROVALS

- UL1577, file no. E52744 system code H, double protection
- CSA 22.2 bulletin 5A
- DIN EN 60747-5-2 (VDE 0884)
- DIN EN 60747-5-5 (pending)
- FIMKO

ORDERING INFORMATION

T	C	E	T	1	6	0	0	#

PART NUMBER



AGENCY CERTIFIED/PACKAGE	CTR (%)
	± 5 mA
UL, cUL, VDE, FIMKO	**20 to 300**
DIP-4, single channel	TCET1600
DIP-4, single channel, 400 mil	TCET1600G

Note

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

ABSOLUTE MAXIMUM RATINGS [1] (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
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	$t_p/T = 0.5$, $t_p \leq 10$ ms	I_{CM}	100	mA
Power dissipation		P_{diss}	150	mW
Junction temperature		T_j	125	°C
COUPLER				
Isolation test voltage (RMS)	t = 1 s	V_{ISO}	5300	V_{RMS}
Isolation voltage		V_{IORM}	890	V_P
Total power dissipation		P_{tot}	250	mW
Operating ambient temperature range		T_{amb}	- 55 to + 100	°C
Storage temperature range		T_{stg}	- 55 to + 150	°C
Soldering temperature [2]	2 mm from case, t ≤ 10 s	T_{sld}	260	°C

Notes

[1] 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.

[2] Refer to wave profile for soldering conditions for through hole devices (DIP).

ELECTRICAL CHARACTERISTCS (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 V, f = 1 MHz	C_j		50		pF
OUTPUT						
Collector emitter voltage	I_C = 100 µA	V_{CEO}	70			V
Emitter collector voltage	I_E = 100 µA	V_{ECO}	7			V
Collector dark current	V_{CE} = 20 V, I_F = 0, E = 0	I_{CEO}			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		100		kHz
Coupling capacitance	f = 1 MHz	C_k		0.3		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**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	V_{CE} = 5 V, I_F = ± 5 mA	CTR	20		300	%

MAXIMUM SAFETY RATINGS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT						
Forward current		I_F			275	mA
OUTPUT						
Power dissipation		P_{diss}			400	mW
COUPLER						
Rated impulse voltage		V_{IOTM}			10	kV
Safety temperature		T_{si}			175	°C

Note

- According to DIN EN 60747-5-2 (VDE 0884) (see figure 1). 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}	1.669			kV
Partial discharge test voltage - lot test (sample test)	t_{Tr} = 60 s, t_{test} = 10 s, (see figure 2)	V_{IOTM}	10			kV
		V_{pd}	1.424			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

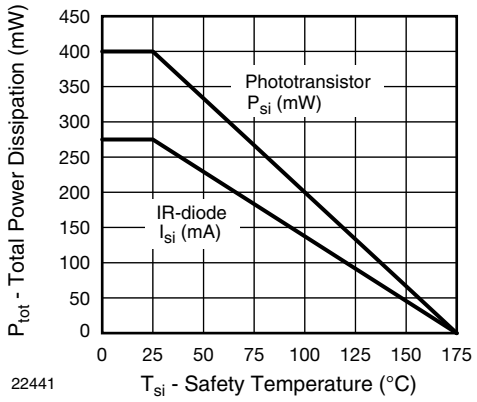


Fig. 1 - Derating Diagram

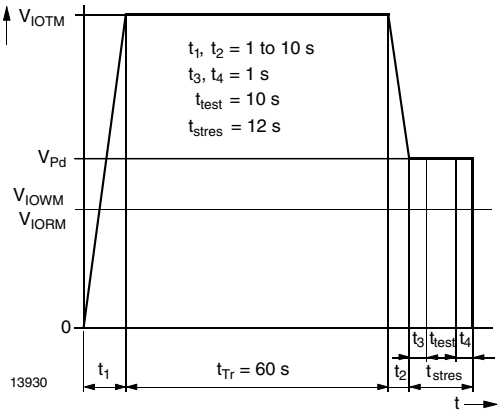


Fig. 2 - Test Pulse Diagram for Sample Test acc. to DIN EN 60747-5-2 (VDE 0884); IEC60747-5-5

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 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
Turn-on time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 3)	t_{on}		6		µs
Storage time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 3)	t_s		0.3		µs
Fall time	V_S = 5 V, I_C = 2 mA, R_L = 100 Ω, (see figure 3)	t_f		4.7		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

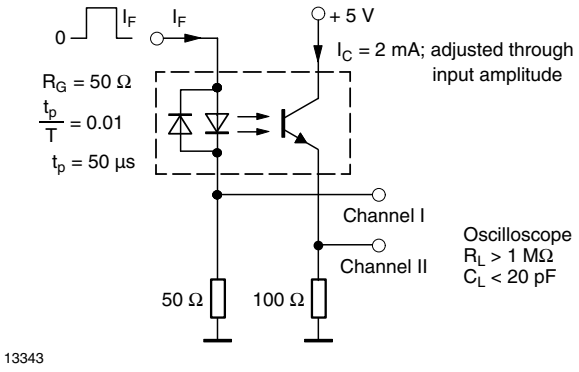


Fig. 3 - Test Circuit, Non-Saturated Operation

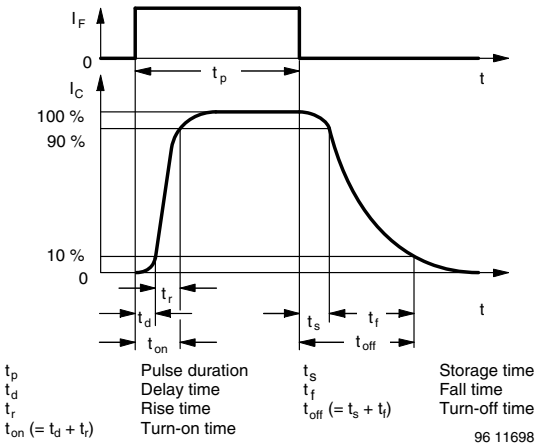


Fig. 5 - Switching Times

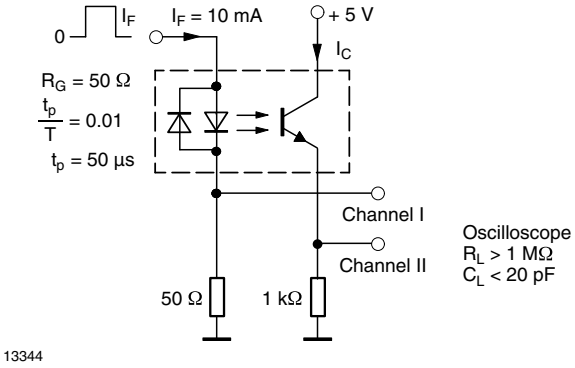


Fig. 4 - Test Circuit, Saturated Operation

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

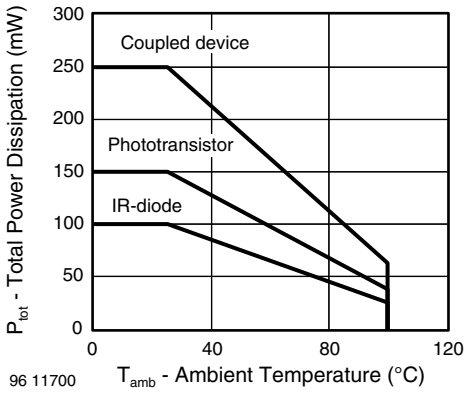


Fig. 6 - Total Power Dissipation vs. Ambient Temperature

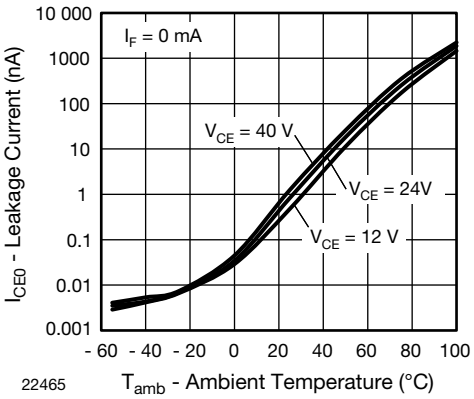


Fig. 9 - Leakage Current vs. Ambient Temperature

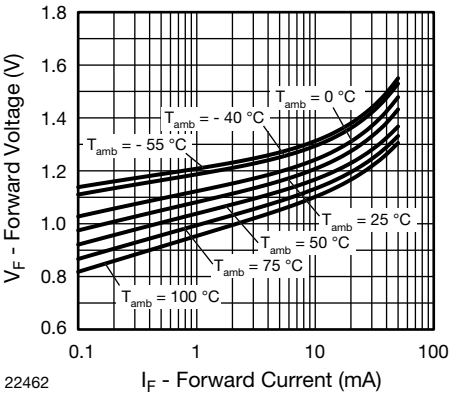


Fig. 7 - Forward Current vs. Forward Voltage

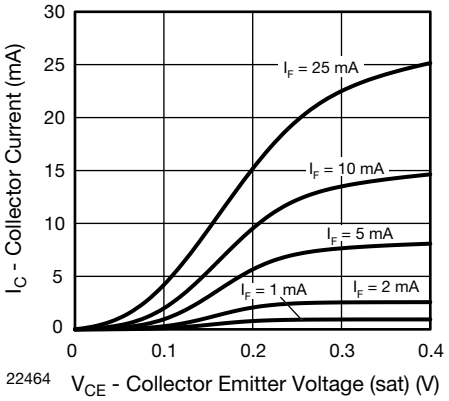


Fig. 10 - Collector Current vs. Collector Emitter Voltage (sat)

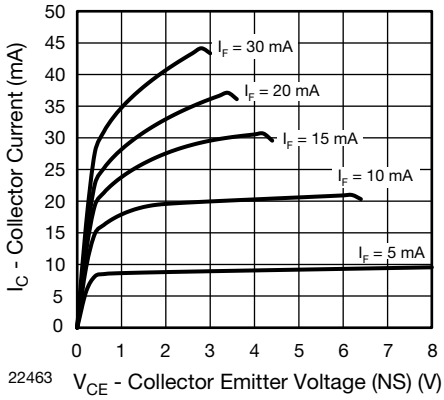


Fig. 8 - Collector Current vs. Collector Emitter Voltage (NS)

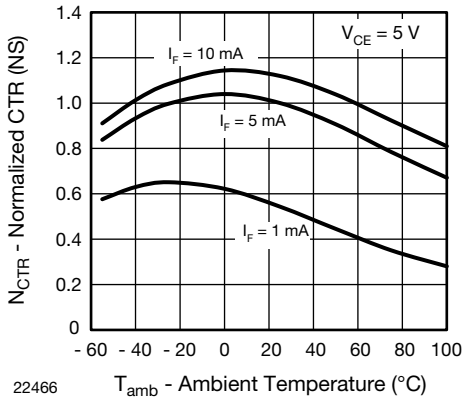


Fig. 11 - Normalized CTR (NS) vs. Ambient Temperature

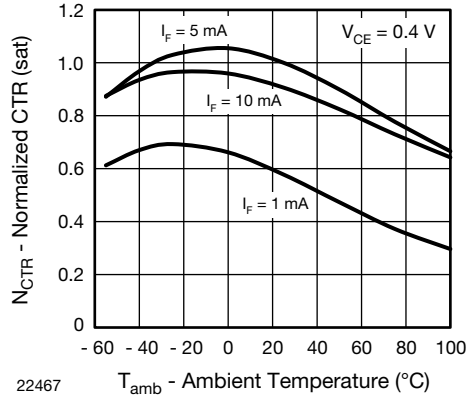


Fig. 12 - Normalized CTR (sat) vs. Ambient Temperature

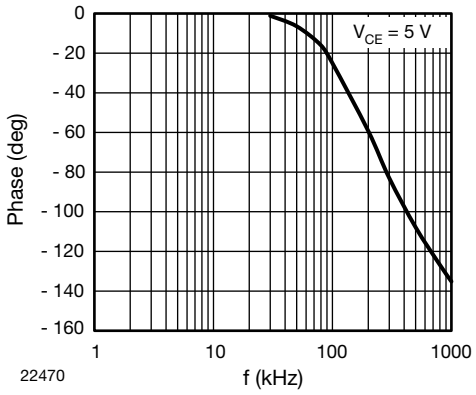


Fig. 15 - F_{CTR} vs. Phase Angle

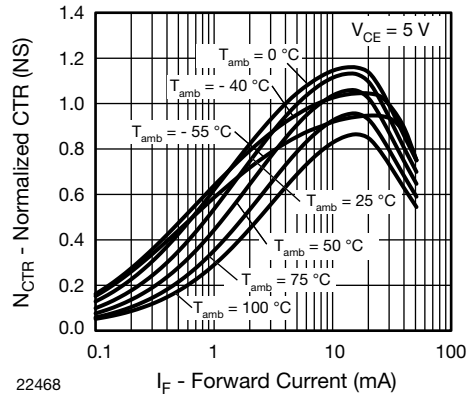


Fig. 13 - Normalized CTR (NS) vs. Forward Current

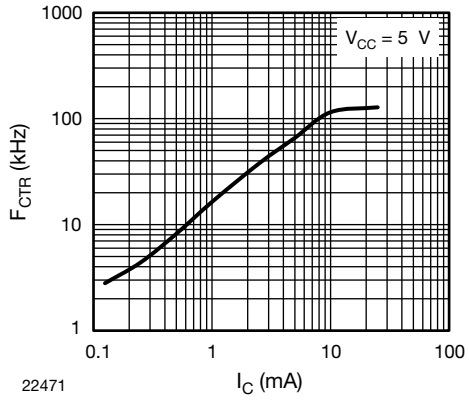


Fig. 16 - F_{CTR} vs. I_C

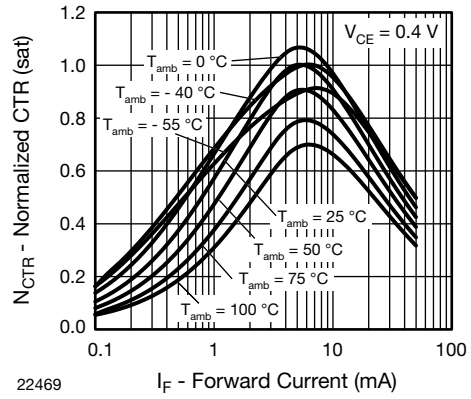


Fig. 14 - Normalized CTR (sat) vs. Forward Current

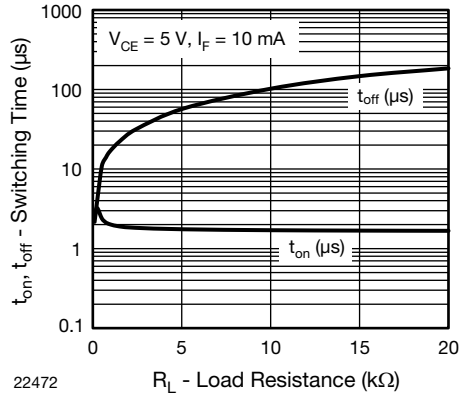
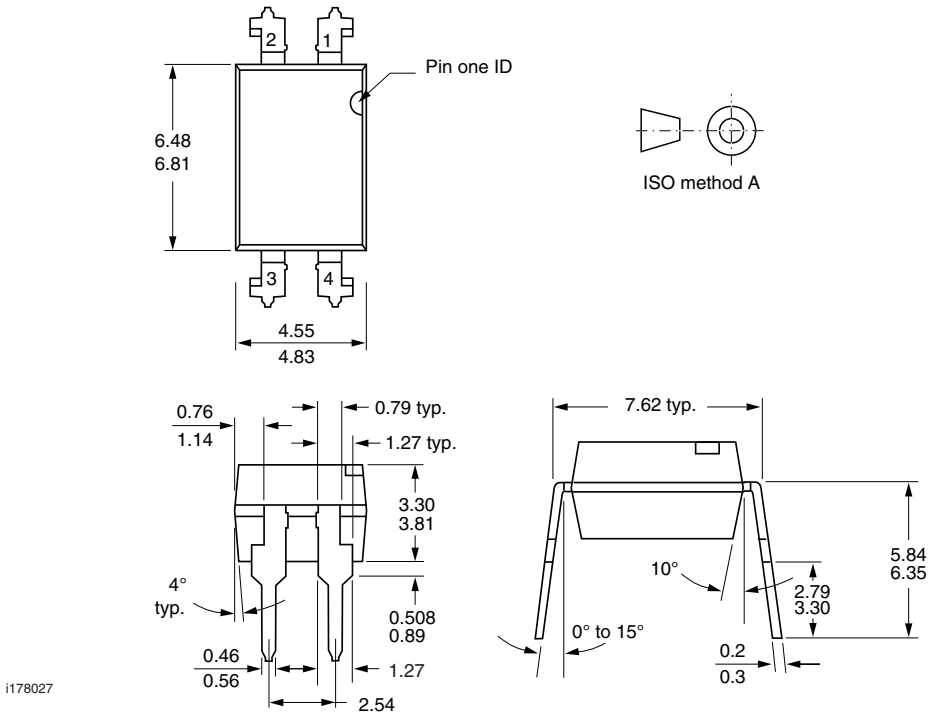
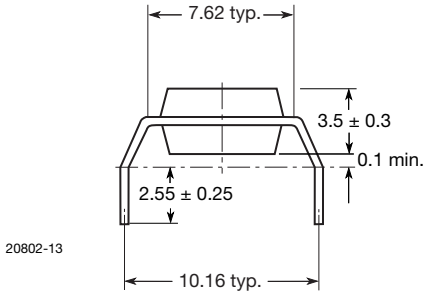


Fig. 17 - Switching Time vs. Load Resistance

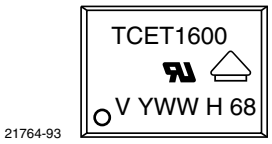
PACKAGE DIMENSIONS in millimeters



Option 6



PACKAGE MARKING (example)



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