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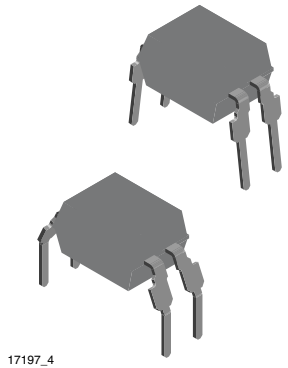
Optocoupler, Phototransistor Output



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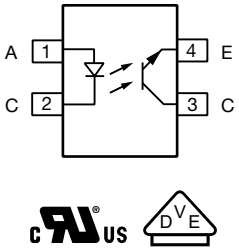

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FEATURES

- 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

Pb-free

e3

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

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 ≤ 400 V_{RMS})
- **VDE 0804**
  Telecommunication apparatus and data processing
- **IEC 60065**
  Safety for mains-operated electronic and related household apparatus

AGENCY APPROVALS

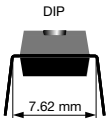
- UL1577, file no. E52744, double protection
- cUL tested to CSA 22.2 bulletin 5A, double protection
- BSI IEC 60950; IEC 60065 pending
- DIN EN 60747-5-2 (VDE 0884)
  DIN EN 60747-5-5 (pending)
- FIMKO

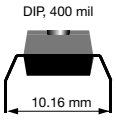
ORDERING INFORMATION

T	C	E	T	1	2	0	#	x

PART NUMBER

PACKAGE OPTION





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.

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}	70	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}	70	mW
Junction temperature		T_j	125	°C
COUPLER				
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	°C
Storage temperature range		T_{stg}	- 55 to + 125	°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.

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 = 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		0.6		pF

Note

- Minimum and maximum values were tested requierements. 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 V, I_F = 5 mA	TCET1200	CTR	50		600	%
		TCET1200G	CTR				%
	V_{CE} = 5 V, I_F = 10 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_{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_{pd}	1.36			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
Rated impulse voltage		V_{IOTM}			6	kV
Max. working voltages	Recurring peak voltage	V_{IORM}	850			V
Forward current		I_F			130	mA
Power dissipation		P_{diss}			265	mW
Safety temperature		T_{si}			150	°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.

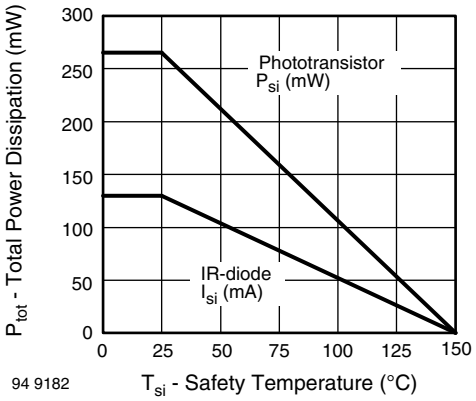


Fig. 1 - Derating Diagram

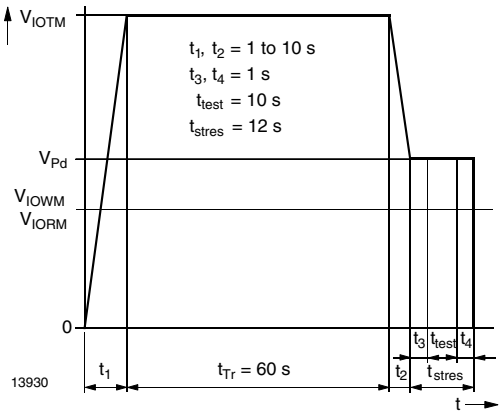


Fig. 2 - Test Pulse Diagram for Sample Test acc. to DIN EN 60747-5-2; IEC60747-5-5

SWITCHING CHARACTERISTICS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Delay time	V_S = 5 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

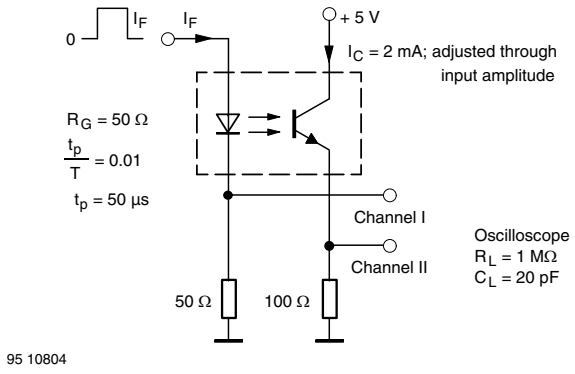


Fig. 3 - Test Circuit, Non-Saturated Operation

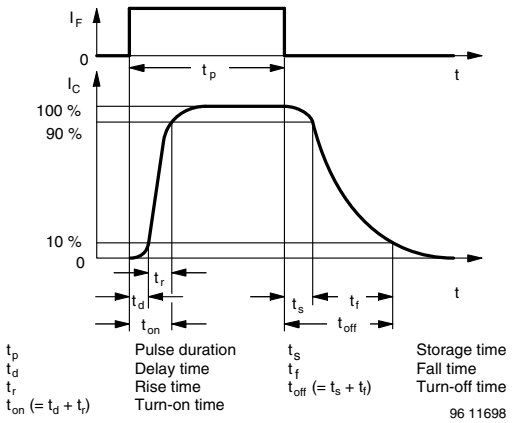


Fig. 5 - Switching Times

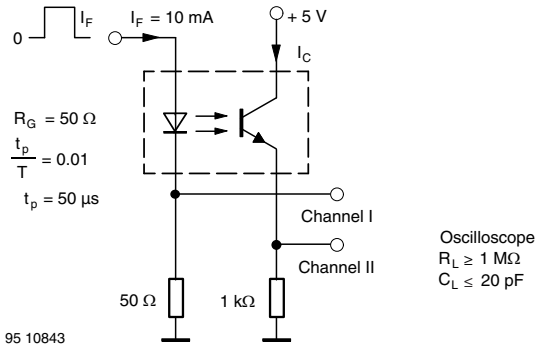


Fig. 4 - Test Circuit, Saturated Operation

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

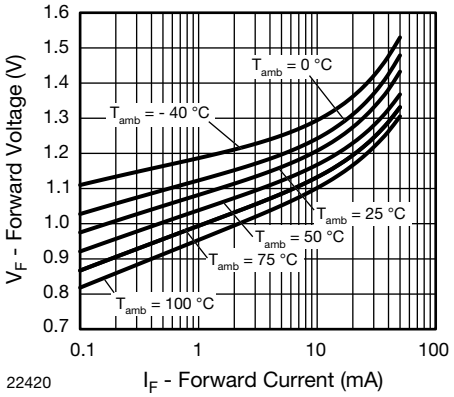


Fig. 6 - Forward Voltage vs. Forward Current

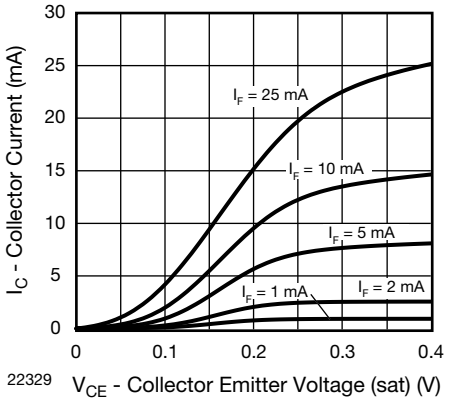


Fig. 9 - Collector Current vs. Collector Emitter Voltage (sat)

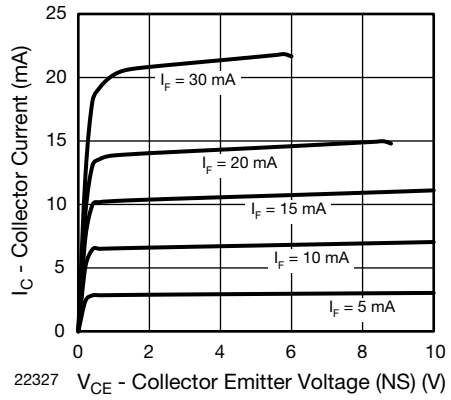


Fig. 7 - Collector Current vs. Collector Emitter Voltage (NS)

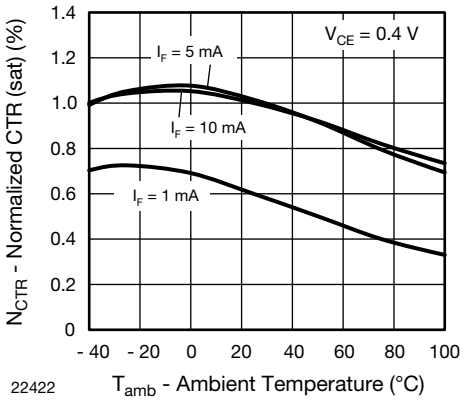


Fig. 10 - Normalized CTR (sat) vs. Ambient Temperature

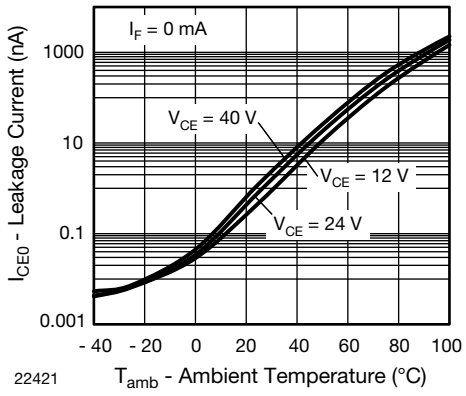


Fig. 8 - Leakage Current vs. Ambient Temperature

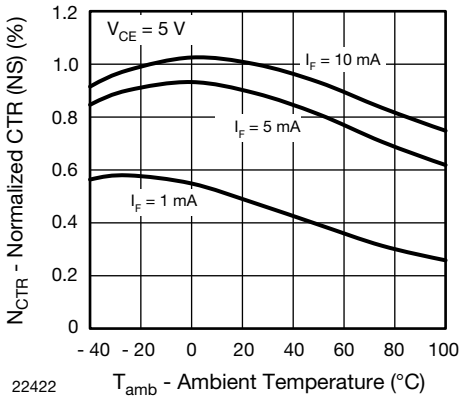


Fig. 11 - Normalized CTR (NS) vs. Ambient Temperature

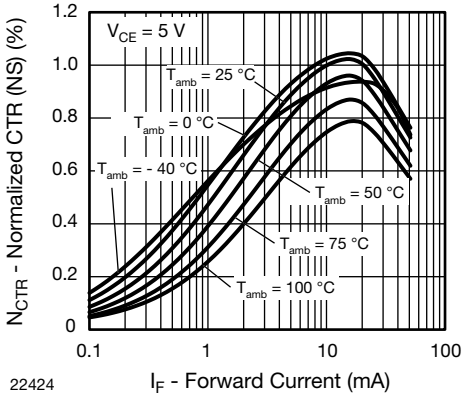


Fig. 12 - Normalized CTR (NS) vs. Forward Current

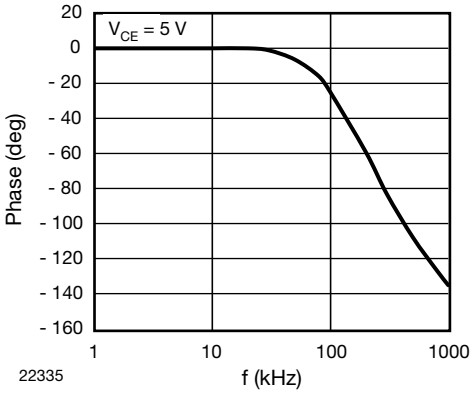


Fig. 15 - F_{CTR} vs. Phase Angle (kHz)

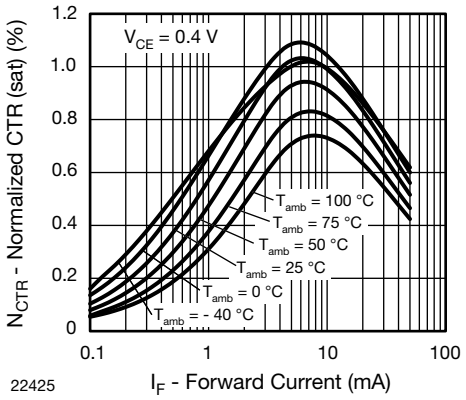


Fig. 13 - Normalized CTR (sat) vs. Forward Current

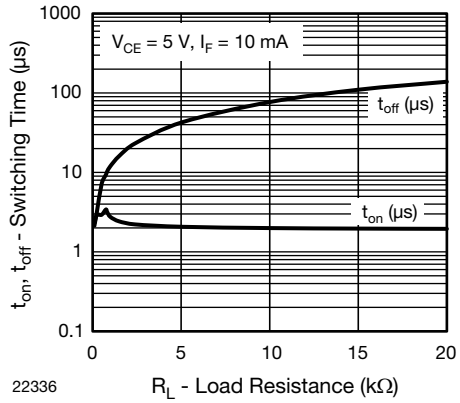


Fig. 16 - Switching Time vs. Load Resistance

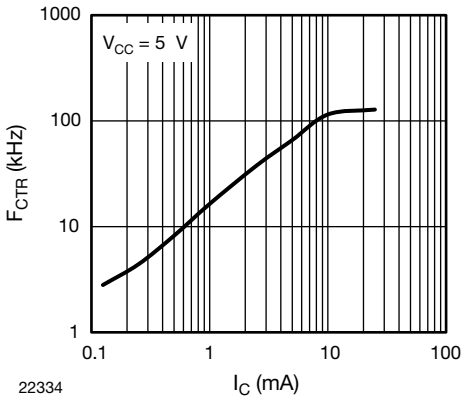
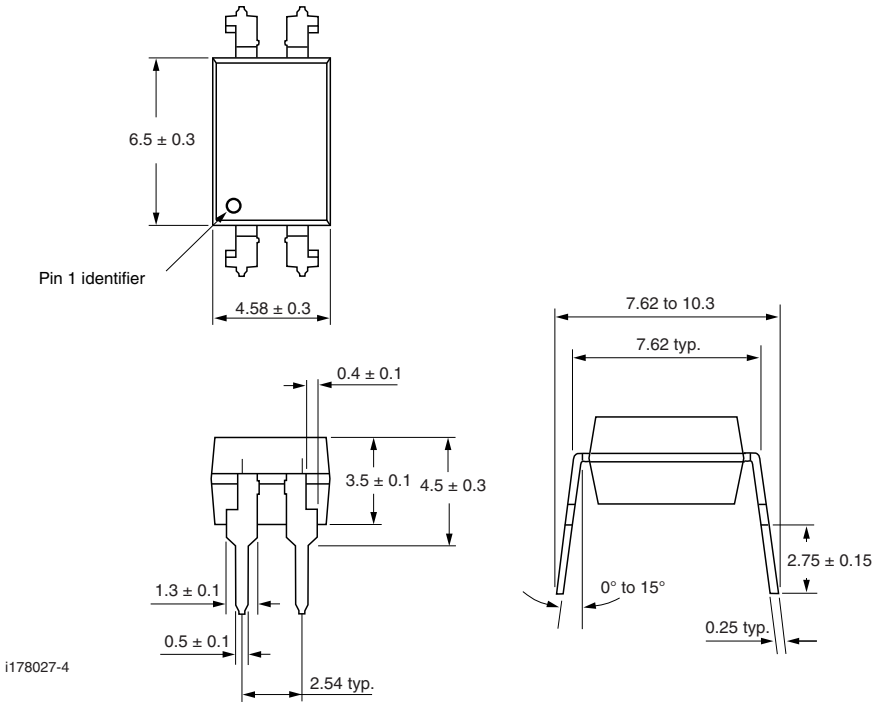
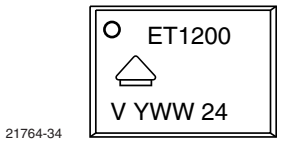


Fig. 14 - F_{CTR} vs. I_C (sat) (mA)

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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