



## Optocoupler, Phototransistor Output (Single, Dual Channel)

### Features

- Extra low coupling capacity - typical 0.2 pF
- High Common Mode Rejection
- CTR offered in 5 groups
- Low temperature coefficient of CTR
- Available in single or dual channel
- Lead-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

### Agency Approvals

- UL1577, File No. E76222 System Code U, Double Protection
- CSA 22.2 bulletin 5A, Double Protection
- BSI IEC60950 IEC60065
- DIN EN 60747-5-2 (VDE0884)  
DIN EN 60747-5-5 pending
- FIMKO

### Applications

Switch-mode power supplies

Line receiver

Computer peripheral interface

Microprocessor system interface

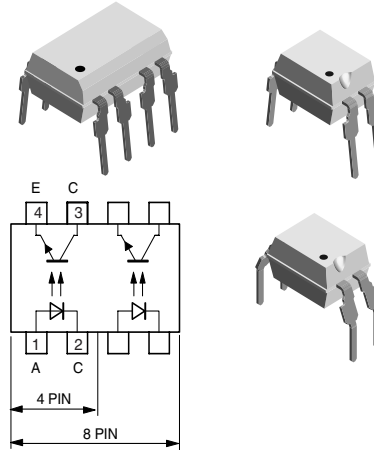
Reinforced Isolation provides circuit protection against electrical shock (Safety Class II)

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

- For appl. class I - IV at mains voltage  $\leq 300$  V
- For appl. class I - III at mains voltage  $\leq 600$  V according to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-5-5 pending, table 2, suitable for:

### Description

The TCET1200/ TCET2200 consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-pin (single channel) or 8-pin plastic dual in line package.



15123



### VDE Standards

These couplers perform safety functions according to the following equipment standards:

**DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-5-5 pending**

Optocoupler for electrical safety requirements  
**IEC 60950/EN 60950**

Office machines (applied for reinforced isolation for mains voltage  $\leq 400$  VRMS)

**VDE 0804**

Telecommunication apparatus and data processing  
**IEC 60065**

Safety for mains-operated electronic and related household apparatus

### Order Information

Part	Remarks
TCET1200	CTR 50 - 600 %, DIP-4
TCET1201	CTR 40 - 80 %, DIP-4
TCET2200	CTR 50 - 600 %, DIP-8
TCET1202	CTR 63 - 125 %, DIP-4
TCET1203	CTR 100 - 200 %, DIP-4
TCET1204	CTR 160 - 320 %, DIP-4
TCET1200G	CTR 50 - 600 %, DIP-4
TCET1201G	CTR 40 - 80 %, DIP-4
TCET1202G	CTR 63 - 125 %, DIP-4
TCET1203G	CTR 100 - 200 %, DIP-4
TCET1204G	CTR 160 - 320 %, DIP-4

G = Leadform 10.16 mm; G is not marked on the body

### Absolute Maximum Ratings

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

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 Rating for extended periods of the time can adversely affect reliability.

### Input

Parameter	Test condition	Symbol	Value	Unit
Reverse voltage		$V_R$	6	V
Forward current		$I_F$	60	mA
Forward surge current	$t_p \leq 10\text{ }\mu\text{s}$	$I_{FSM}$	1.5	A
Power dissipation		$P_{diss}$	100	mW
Junction temperature		$T_j$	125	$^{\circ}\text{C}$

### Output

Parameter	Test condition	Symbol	Value	Unit
Collector emitter voltage		$V_{CEO}$	70	V
Emitter collector voltage		$V_{ECO}$	7	V
Collector current		$I_C$	50	mA
Collector peak current	$t_p/T = 0.5, t_p \leq 10\text{ ms}$	$I_{CM}$	100	mA
Power dissipation		$P_{diss}$	150	mW
Junction temperature		$T_j$	125	$^{\circ}\text{C}$

### Coupler

Parameter	Test condition	Symbol	Value	Unit
Isolation test voltage (RMS)		$V_{ISO}$	5000	$V_{RMS}$
Total power dissipation		$P_{tot}$	250	mW
Operating ambient temperature range		$T_{amb}$	- 40 to + 100	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	- 55 to + 125	$^{\circ}\text{C}$
Soldering temperature	2 mm from case $t \leq 10\text{ s}$	$T_{sld}$	260	$^{\circ}\text{C}$



## Electrical Characteristics

T<sub>amb</sub> = 25 °C, unless otherwise specified

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.

### Input

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Forward voltage	I <sub>F</sub> = ± 50 mA	V <sub>F</sub>		1.25	1.6	V
Junction capacitance	V <sub>R</sub> = 0 V, f = 1 MHz	C <sub>j</sub>		50		pF

### Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector emitter voltage	I <sub>C</sub> = 1 mA	V <sub>CEO</sub>	70			V
Emitter collector voltage	I <sub>E</sub> = 100 μA	V <sub>ECO</sub>	7			V
Collector-emitter cut-off current	V <sub>CE</sub> = 20 V, I <sub>F</sub> = 0, E = 0	I <sub>CEO</sub>		10	100	nA

### Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector emitter saturation voltage	I <sub>F</sub> = 10 mA, I <sub>C</sub> = 1 mA	V <sub>CEsat</sub>			0.3	V
Cut-off frequency	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 10 mA, R <sub>L</sub> = 100 Ω	f <sub>c</sub>		110		kHz
Coupling capacitance	f = 1 MHz	C <sub>k</sub>		0.3		pF

### Current Transfer Ratio

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
I <sub>C</sub> /I <sub>F</sub>	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 5 mA	TCET1200 TCET1200G	CTR	50		600	%
		V <sub>CE</sub> = 5 V, I <sub>F</sub> = 10 mA	TCET1201 TCET1201G	CTR	40		80
	TCET1202 TCET1202G		CTR	63		125	%
	TCET1203 TCET1203G		CTR	100		200	%
	TCET1204 TCET1204G		CTR	160		320	%
	V <sub>CE</sub> = 5 V, I <sub>F</sub> = 5 mA	TCET2200	CTR	50		600	%

### Maximum Safety Ratings

(according to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-5-5 pending) 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.

### Input

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Forward current		I <sub>F</sub>			130	mA

### Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Power dissipation		$P_{diss}$			265	mW

### Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Rated impulse voltage		$V_{IOTM}$			8	kV
Safety temperature		$T_{si}$			150	°C

### 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	$R_{IO}$	$10^{12}$			$\Omega$
	$V_{IO} = 500$ V, $T_{amb} = 100$ °C	$R_{IO}$	$10^{11}$			$\Omega$
	$V_{IO} = 500$ V, $T_{amb} = 150$ °C (construction test only)	$R_{IO}$	$10^9$			$\Omega$

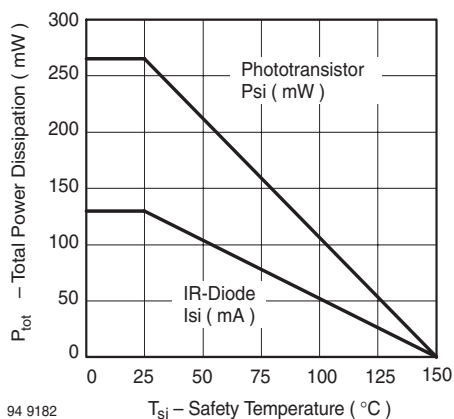


Figure 1. Derating diagram

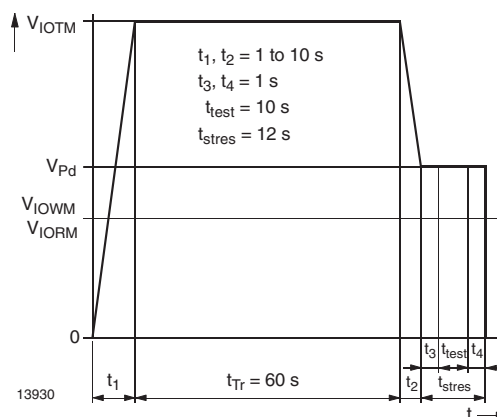


Figure 2. Test pulse diagram for sample test according to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-; IEC60747

## 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 figure 3)	$t_d$		3.0		$\mu\text{S}$
Rise time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ (see figure 3)	$t_r$		3.0		$\mu\text{S}$
Turn-on time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ (see figure 3)	$t_{on}$		6.0		$\mu\text{S}$
Storage time	$V_S = 5\text{ V}$ , $I_C = 2\text{ mA}$ , $R_L = 100\ \Omega$ (see figure 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 figure 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 figure 3)	$t_{off}$		5.0		$\mu\text{S}$
Turn-on time	$V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ (see figure 4)	$t_{on}$		9.0		$\mu\text{S}$
Turn-off time	$V_S = 5\text{ V}$ , $I_F = 10\text{ mA}$ , $R_L = 1\text{ k}\Omega$ (see figure 4)	$t_{off}$		10.0		$\mu\text{S}$



Figure 3. Test circuit, non-saturated operation



Figure 5. Switching Times



Figure 4. Test circuit, saturated operation

## Typical Characteristics ( $T_{amb} = 25\text{ }^{\circ}\text{C}$ unless otherwise specified)



Figure 6. Total Power Dissipation vs. Ambient Temperature

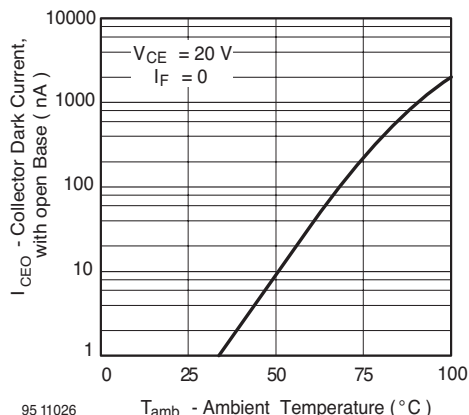


Figure 9. Collector Dark Current vs. Ambient Temperature



Figure 7. Forward Current vs. Forward Voltage

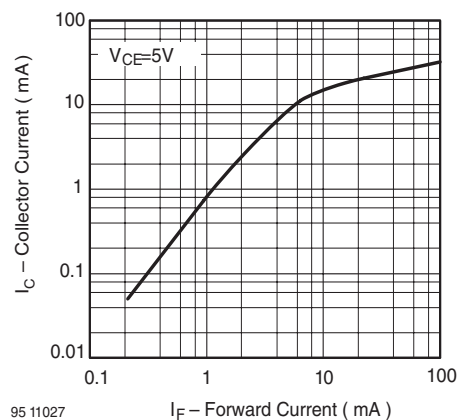


Figure 10. Collector Current vs. Forward Current



Figure 8. Relative Current Transfer Ratio vs. Ambient Temperature

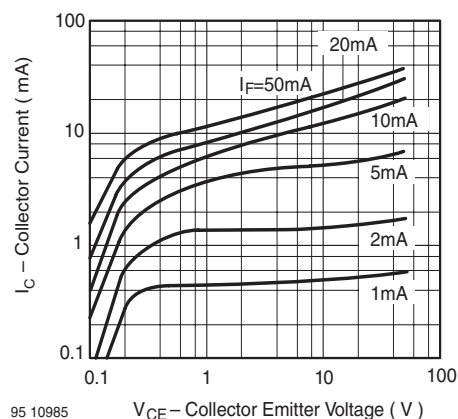


Figure 11. Collector Current vs. Collector Emitter Voltage



Figure 12. Collector Emitter Saturation Voltage vs. Collector Current



Figure 15. Turn on / off Time vs. Forward Current



Figure 13. Current Transfer Ratio vs. Forward Current



Figure 14. Turn on / off Time vs. Collector Current

# TCET1200/ TCET1200G/ TCET2200



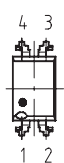
Vishay Semiconductors

## Package Dimensions in mm



E.g.:  
special Features: endstackable  
to 2.54mm (.100") spacing

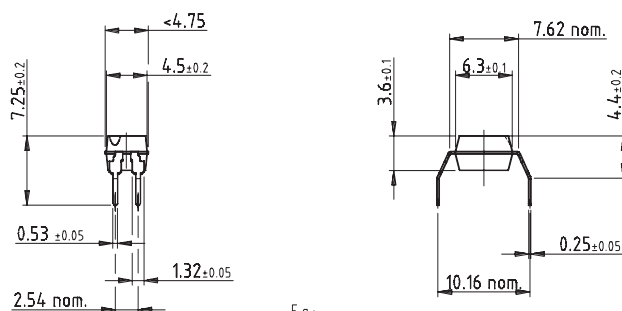
weight : ca 0.25g  
creepage distance : > 6mm  
air path : > 6mm  
after mounting on PC board



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Issue: 5; 20.03.02

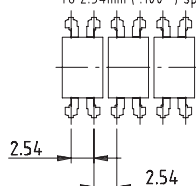
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## Package Dimensions in mm



E.g.:  
special Features: endstackable  
to 2.54mm (.100") spacing

weight : ca 0.25g  
creepage distance : > 8mm  
air path : > 8mm  
after mounting on PC board

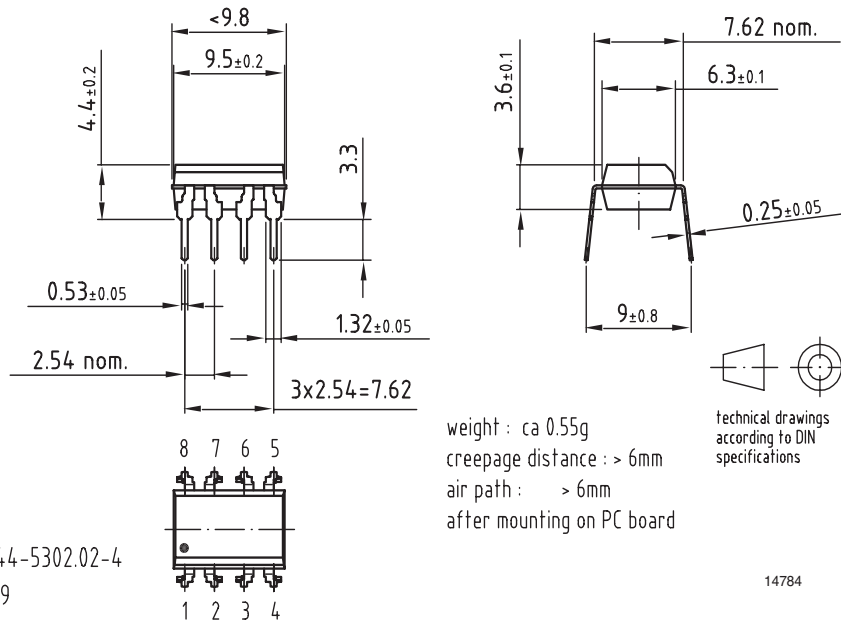


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Issue: 4; 20.03.02

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## Package Dimensions in mm



Drawing-No.: 6.544-5302.02-4  
 Issue: 4; 02.06.99

### Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

We reserve the right to make changes to improve technical design  
and may do so without further notice.

Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify Vishay Semiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany  
Telephone: 49 (0)7131 67 2831, Fax number: 49 (0)7131 67 2423



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**Телефон:** +7 812 627 14 35

**Электронная почта:** [sales@st-electron.ru](mailto:sales@st-electron.ru)

**Адрес:** 198099, Санкт-Петербург,  
Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331