

## Optocoupler, Phototransistor Output

### Features

- Isolation Test Voltage 3750 V<sub>RMS</sub>
- Extra low coupling capacity - typical 0.2 pF
- High Common Mode Rejection
- No base terminal connection for improved noise immunity
- CTR offered in 4 groups
- Thickness through insulation > 0.75 mm
- Creepage current resistance according to VDE 0303/IEC 60112 Comparative Tracking Index: CTI = 275

### Agency Approvals

- UL - File No. E76222 System Code A
- BSI IEC60950 IEC60065
- DIN EN 60747-5-2(VDE0884)  
DIN EN 60747-5-5 pending
- FIMKO

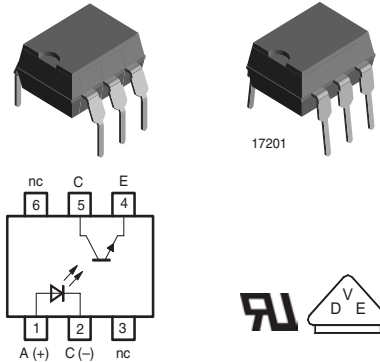
### Applications

- Switch-mode power supplies
- Line receiver
- Computer peripheral interface
- Microprocessor system interface
- 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(VDE0884)/ DIN EN 60747-5-5 pending, table 2.

### Description

The TCDT1100/ TCDT1100G series consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 6-pin plastic dual inline package. The base of the phototransistor is not connected providing noise immunity.

The elements are mounted on one leadframe which provides a fixed distance between input and output for highest safety requirements.



### 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 ≤ 400 VRMS)

**VDE 0804**

Telecommunication apparatus and data processing

**IEC 60065**

Safety for mains-operated electronic and related household apparatus

### Order Information

Part	Remarks
TCDT1100	CTR > 40 %, DIP-6
TCDT1101	CTR 40 - 80 %, DIP-6
TCDT1102	CTR 63 - 125 %, DIP-6
TCDT1103	CTR 100 - 200 %, DIP-6
TCDT1100G	CTR > 40 %, DIP-6
TCDT1101G	CTR 40 - 80 %, DIP-6
TCDT1102G	CTR 63 - 125 %, DIP-6
TCDT1103G	CTR 100 - 200 %, DIP-6

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		$V_R$	5	V
Forward current		$I_F$	60	mA
Forward surge current	$t_p \leq 10\text{ }\mu\text{s}$	$I_{FSM}$	3	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		$V_{CEO}$	32	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)		$V_{ISO}$	3750	$V_{RMS}$
Total power dissipation		$P_{tot}$	250	mW
Ambient temperature range		$T_{amb}$	- 55 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

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , 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	$I_F = 50\text{ mA}$	$V_F$		1.25	1.6	V
Junction capacitance	$V_R = 0, f = 1\text{ MHz}$	$C_j$		50		pF

### Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector emitter voltage	$I_C = 1\text{ mA}$	$V_{CEO}$	32			V
Emitter collector voltage	$I_E = 100\text{ }\mu\text{A}$	$V_{ECO}$	7			V
Collector-emitter cut-off current	$V_{CE} = 20\text{ V}, I_f = 0, E = 0$	$I_{CEO}$		200		nA

## Coupler

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector emitter saturation voltage	$I_F = 10 \text{ mA}$ , $I_C = 1 \text{ mA}$	$V_{CEsat}$			0.3	V
Cut-off frequency	$V_{CE} = 5 \text{ V}$ , $I_F = 10 \text{ mA}$ , $R_L = 100 \Omega$	$f_c$		110		kHz
Coupling capacitance	$f = 1 \text{ MHz}$	$C_k$		0.3		pF

## Current Transfer Ratio

Parameter	Test condition	Part	Symbol	Min	Typ.	Max	Unit
$I_C/I_F$	$V_{CE} = 5 \text{ V}$ , $I_F = 10 \text{ mA}$	TCDT1100 TCDT1100G	CTR	40			%
		TCDT1101 TCDT1101G	CTR	40		80	%
		TCDT1102 TCDT1102G	CTR	63		125	%
		TCDT1103 TCDT1103G	CTR	100		200	%

## 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		$I_F$			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		$V_{IOTM}$			6	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 %, $t_{test} = 1 \text{ s}$	$V_{pd}$	1.6			kV
Partial discharge test voltage - Lot test (sample test)	$t_{Tr} = 60 \text{ s}$ , $t_{test} = 10 \text{ s}$ , (see figure 2)	$V_{IOTM}$	6			kV
		$V_{pd}$	1.3			kV
Insulation resistance	$V_{IO} = 500 \text{ V}$	$R_{IO}$	$10^{12}$			$\Omega$
	$V_{IO} = 500 \text{ V}$ , $T_{amb} = 100 \text{ °C}$	$R_{IO}$	$10^{11}$			$\Omega$
	$V_{IO} = 500 \text{ V}$ , $T_{amb} = 150 \text{ °C}$ (construction test only)	$R_{IO}$	$10^9$			$\Omega$

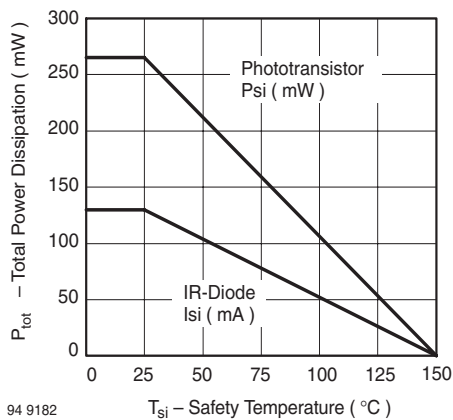


Figure 1. Derating diagram

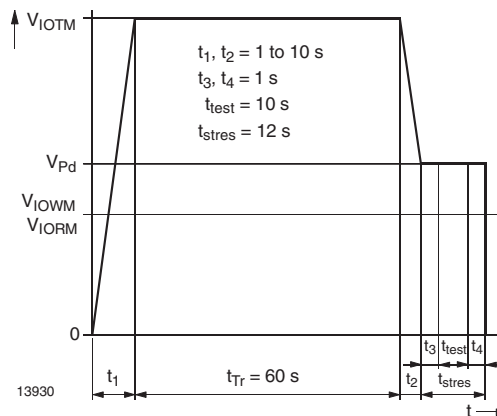


Figure 2. Test pulse diagram for sample test according to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-; IEC60747

## Switching Characteristics

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Delay time	$V_S = 5$ V, $I_C = 5$ mA, $R_L = 100 \Omega$ (see figure 3)	$t_d$		4.0		$\mu$ s
Rise time	$V_S = 5$ V, $I_C = 5$ mA, $R_L = 100 \Omega$ (see figure 3)	$t_r$		7.0		$\mu$ s
Fall time	$V_S = 5$ V, $I_C = 5$ mA, $R_L = 100 \Omega$ (see figure 3)	$t_f$		6.7		$\mu$ s
Storage time	$V_S = 5$ V, $I_C = 5$ mA, $R_L = 100 \Omega$ (see figure 3)	$t_s$		0.3		$\mu$ s
Turn-on time	$V_S = 5$ V, $I_C = 5$ mA, $R_L = 100 \Omega$ (see figure 3)	$t_{on}$		11.0		$\mu$ s
Turn-off time	$V_S = 5$ V, $I_C = 5$ mA, $R_L = 100 \Omega$ (see figure 3)	$t_{off}$		7.0		$\mu$ s
Turn-on time	$V_S = 5$ V, $I_F = 10$ mA, $R_L = 1$ k $\Omega$ (see figure 4)	$t_{on}$		25.0		$\mu$ s
Turn-off time	$V_S = 5$ V, $I_F = 10$ mA, $R_L = 1$ k $\Omega$ (see figure 4)	$t_{off}$		42.5		$\mu$ s

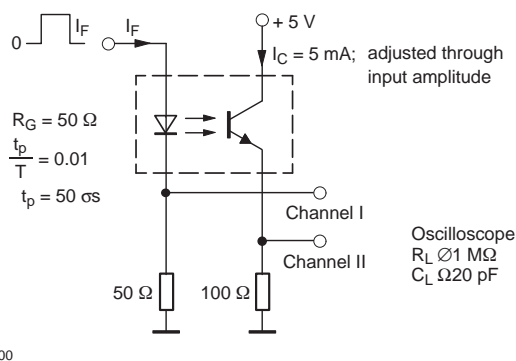


Figure 3. Test circuit, non-saturated operation

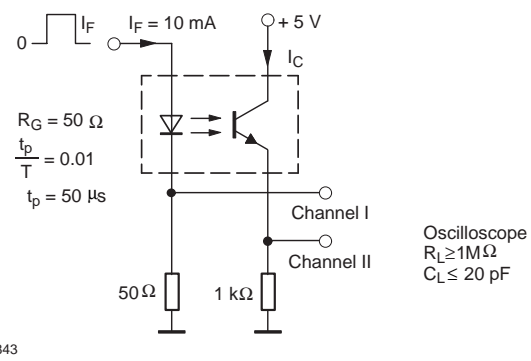


Figure 4. Test circuit, saturated operation

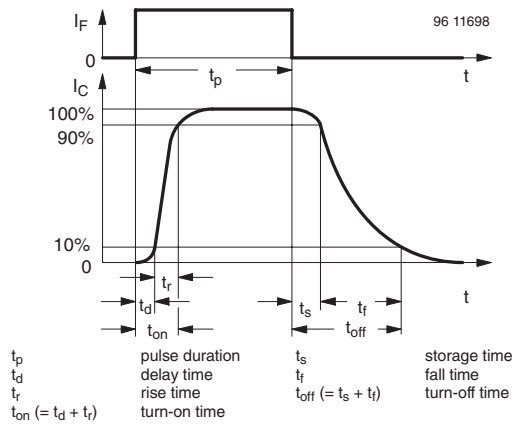


Figure 5. Switching times

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

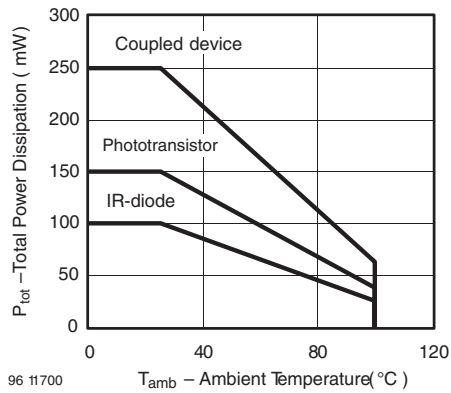


Figure 6. Total Power Dissipation vs. Ambient Temperature

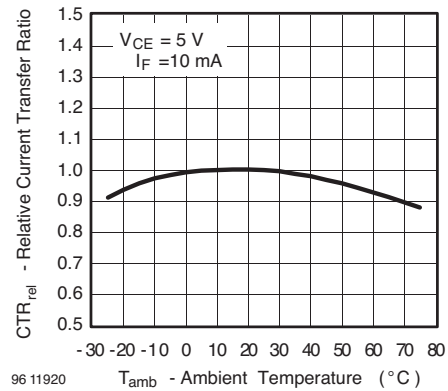


Figure 8. Relative Current Transfer Ratio vs. Ambient Temperature

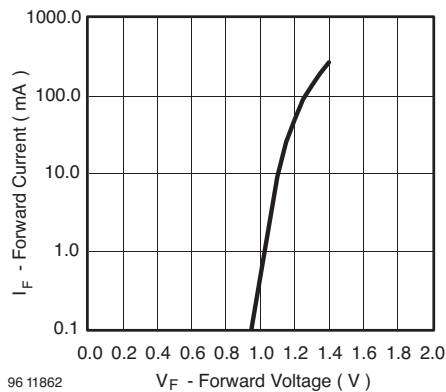


Figure 7. Forward Current vs. Forward Voltage

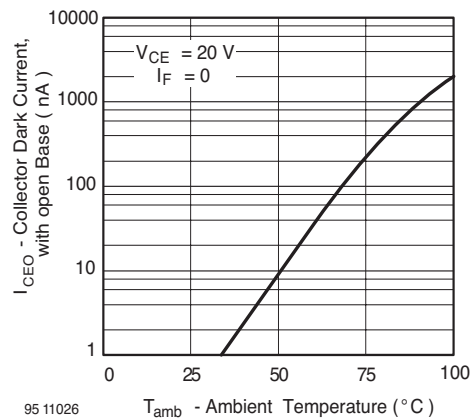


Figure 9. Collector Dark Current vs. Ambient Temperature

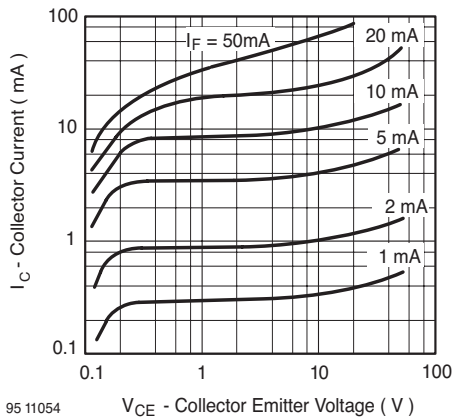


Figure 10. Collector Current vs. Collector Emitter Voltage

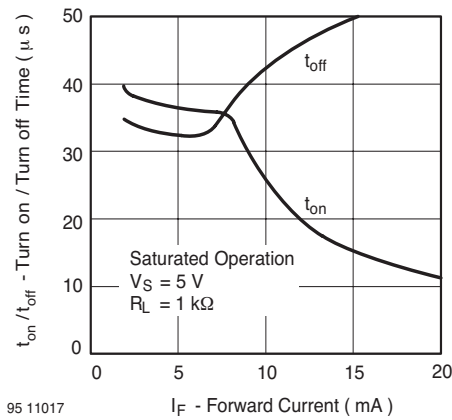


Figure 13. Turn on / off Time vs. Forward Current

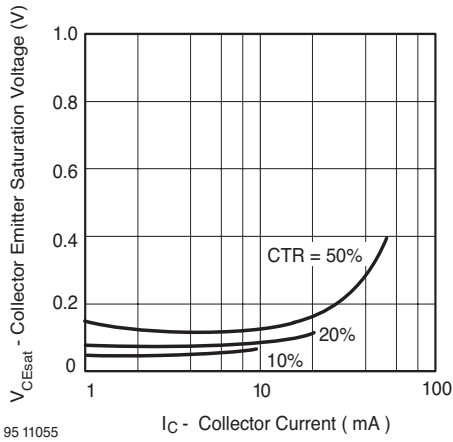


Figure 11. Collector Emitter Saturation Voltage vs. Collector Current

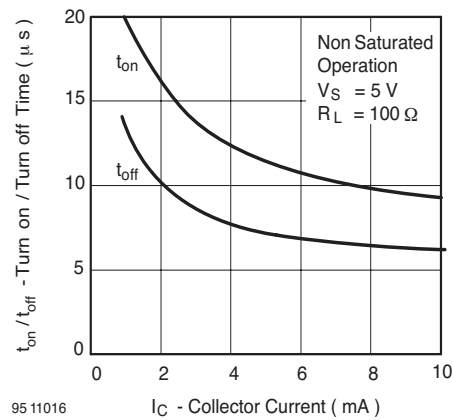


Figure 14. Turn on / off Time vs. Collector Current

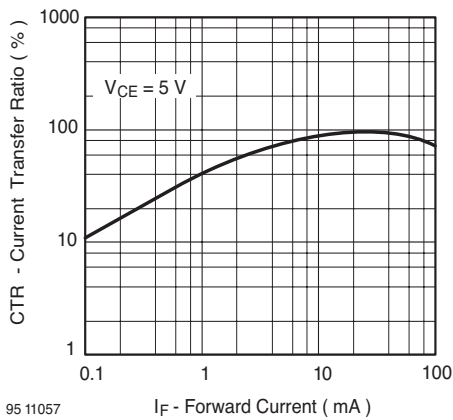


Figure 12. Current Transfer Ratio vs. Forward Current

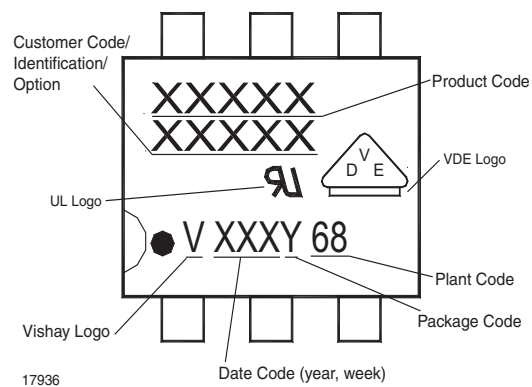
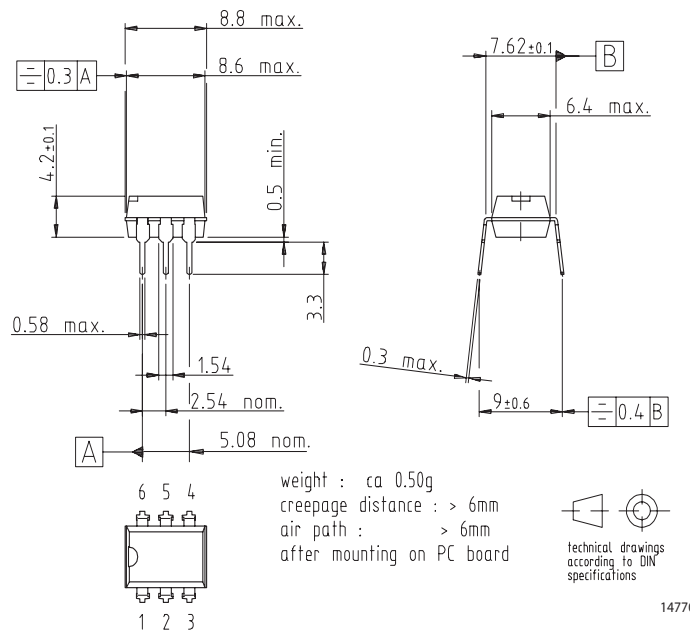
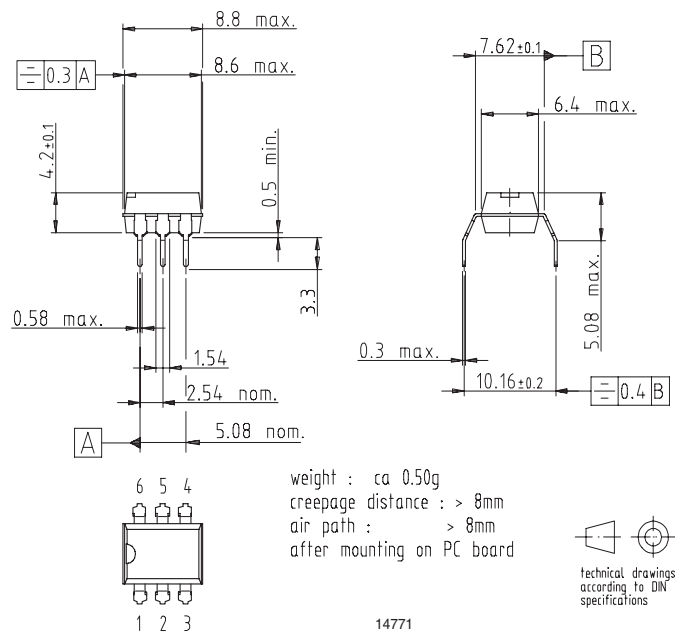


Figure 15. Marking example

## Package Dimensions in mm



## Package Dimensions in mm



### 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.

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