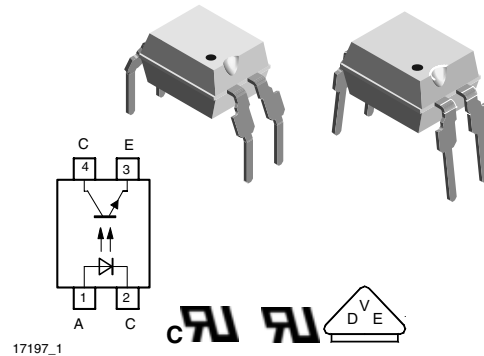


Optocoupler, Phototransistor Output, High Temperature

Features

- Extra low coupling capacity - typical 0.2 pF
- High Common Mode Rejection
- Low temperature coefficient of CTR
- CTR offered in 9 groups
- Reinforced Isolation provides circuit protection against electrical shock (Safety Class II)
- Lead-(Pb)-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: EN 60065:2002, EN 60950:2000 Certificate No. 7081 and 7402
- 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 TCET110. consists of a phototransistor optically coupled to a gallium arsenide infrared-emitting diode in a 4-lead plastic dual in-line package.

The elements are mounted on one leadframe using a **coplanar technique**, providing a fixed distance between input and output for highest safety requirements.

Isolation materials according to UL94-VO

Pollution degree 2 (DIN/VDE 0110 / resp. IEC 60664)

Climatic classification 55/100/21 (IEC 60068 part 1)

Rated impulse voltage (transient overvoltage)

$V_{IOTM} = 8$ kV peak

Isolation test voltage (partial discharge test voltage)

$V_{pd} = 1.6$ kV

Rated isolation voltage (RMS includes DC)

$V_{IOWM} = 600 V_{RMS}$ (848 V peak)

Rated recurring peak voltage (repetitive)

$V_{IORM} = 600 V_{RMS}$

Thickness through insulation ≥ 0.75 mm

Internal creepage distance > 4 mm

Creepage current resistance according to VDE 0303/

IEC 112 Comparative Tracking Index:

CTI ≥ 175

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
TCET1100	CTR 50 - 600 %, DIP-4
TCET1101	CTR 40 - 80 %, DIP-4
TCET1102	CTR 63 - 125 %, DIP-4
TCET1103	CTR 100 - 200 %, DIP-4
TCET1104	CTR 160 - 320 %, DIP-4
TCET1105	CTR 50 - 150 %, DIP-4
TCET1106	CTR 100 - 300 %, DIP-4
TCET1107	CTR 80 - 160 %, DIP-4
TCET1108	CTR 130 - 260 %, DIP-4
TCET1109	CTR 200 - 400 %, DIP-4
TCET1100G	CTR 50 - 600 %, DIP-4
TCET1101G	CTR 40 - 80 %, DIP-4
TCET1102G	CTR 63 - 125 %, DIP-4
TCET1103G	CTR 100 - 200 %, DIP-4
TCET1104G	CTR 160 - 320 %, DIP-4
TCET1105G	CTR 50 - 150 %, DIP-4
TCET1106G	CTR 100 - 300 %, DIP-4
TCET1107G	CTR 80 - 160 %, DIP-4
TCET1108G	CTR 130 - 260 %, DIP-4
TCET1109G	CTR 200 - 400 %, 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

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

Coupler

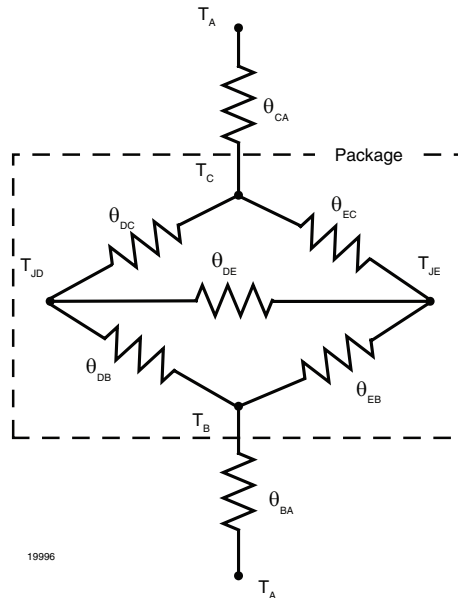
Parameter	Test condition	Symbol	Value	Unit
Isolation test voltage (RMS)	t = 1 min	V_{ISO}	5000	V_{RMS}
Operating ambient temperature range		T_{amb}	- 40 to + 100	$^{\circ}C$
Storage temperature range		T_{stg}	- 55 to + 125	$^{\circ}C$
Soldering temperature	2 mm from case t ≤ 10 s	T_{sld}	260	$^{\circ}C$

Thermal Characteristics

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.

Parameter	Test condition	Symbol	Value	Unit
LED Power dissipation	at 25 $^{\circ}C$	P_{diss}	100	mW
Output Power dissipation	at 25 $^{\circ}C$	P_{diss}	150	mW
Maximum LED junction temperature		T_{jmax}	125	$^{\circ}C$
Maximum output die junction temperature		T_{jmax}	125	$^{\circ}C$
Thermal resistance, Junction Emitter to Board		θ_{EB}	173	$^{\circ}C/W$
Thermal resistance, Junction Emitter to Case		θ_{EC}	149	$^{\circ}C/W$
Thermal resistance, Junction Detector to Board		θ_{DB}	111	$^{\circ}C/W$
Thermal resistance, Junction Detector to Case		θ_{DC}	127	$^{\circ}C/W$
Thermal resistance, Junction Emitter to Junction Detector		θ_{ED}	173	$^{\circ}C/W$
Thermal resistance, Board to Ambient*		θ_{BA}	197	$^{\circ}C/W$
Thermal resistance, Case to Ambient*		θ_{CA}	4041	$^{\circ}C/W$

* For 2 layer FR4 board (4" x 3" x 0.062)



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	$V_R = 0\text{ V}$, $f = 1\text{ MHz}$	C_j		50		pF

Output

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector emitter voltage	$I_C = 1\text{ mA}$	V_{CEO}	70			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}		10	100	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	$V_{CE} = 5\text{ V}$, $I_F = 10\text{ mA}$, $R_L = 100\text{ }\Omega$	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	$V_{CE} = 5\text{ V}$, $I_F = 1\text{ mA}$	TCET1101 TCET1101G	CTR	13	30		%
		TCET1102 TCET1102G	CTR	22	45		%
		TCET1103 TCET1103G	CTR	34	70		%
		TCET1104 TCET1104G	CTR	56	90		%
	$V_{CE} = 5\text{ V}$, $I_F = 5\text{ mA}$	TCET1100 TCET1100G	CTR	50		600	%
		TCET1105 TCET1105G	CTR	50		150	%
		TCET1106 TCET1106G	CTR	100		300	%
		TCET1107 TCET1107G	CTR	80		160	%
		TCET1108 TCET1108G	CTR	130		260	%
		TCET1109 TCET1109G	CTR	200		400	%
	$V_{CE} = 5\text{ V}$, $I_F = 10\text{ mA}$	TCET1101 TCET1101G	CTR	40		80	%
		TCET1102 TCET1102G	CTR	63		125	%
		TCET1103 TCET1103G	CTR	100		200	%
		TCET1104 TCET1104G	CTR	160		320	%

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}			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}			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

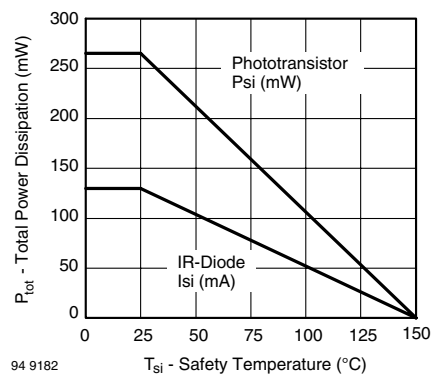


Figure 1. Derating diagram

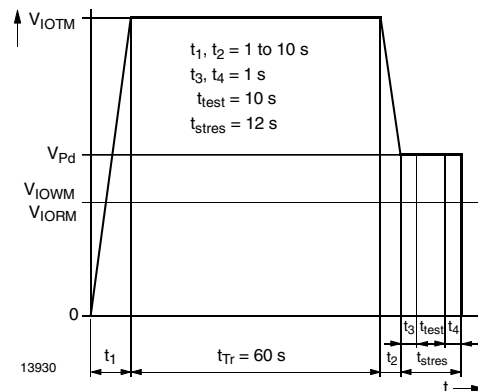
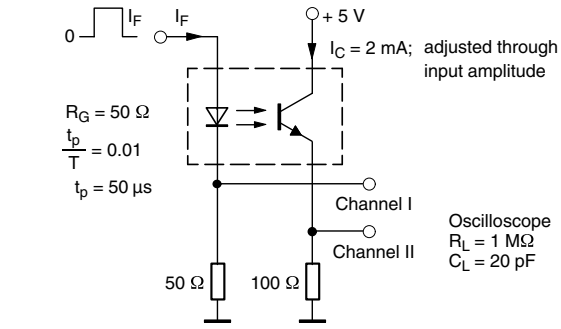


Figure 2. Test pulse diagram for sample test according to DIN EN 60747-5-2(VDE0884)/ DIN EN 60747-; IEC60747

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		μs
Rise time	$V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\ \Omega$ (see figure 3)	t_r		3.0		μs
Turn-on time	$V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\ \Omega$ (see figure 3)	t_{on}		6.0		μs
Storage time	$V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\ \Omega$ (see figure 3)	t_s		0.3		μs
Fall time	$V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\ \Omega$ (see figure 3)	t_f		4.7		μs
Turn-off time	$V_S = 5\text{ V}$, $I_C = 2\text{ mA}$, $R_L = 100\ \Omega$ (see figure 3)	t_{off}		5.0		μs
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		μs
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		μs



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Figure 3. Test circuit, non-saturated operation

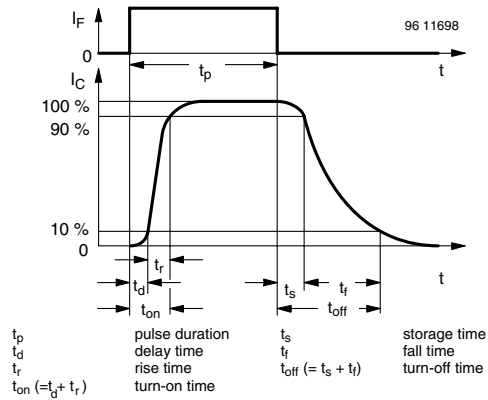
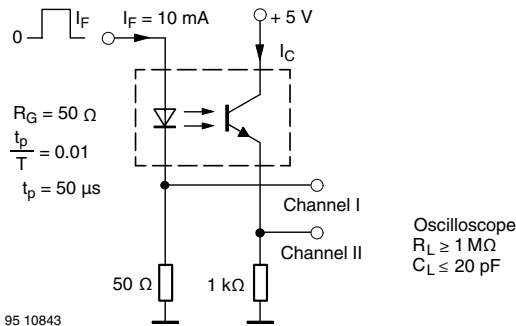


Figure 5. Switching Times



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Figure 4. Test circuit, saturated operation

Typical Characteristics

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

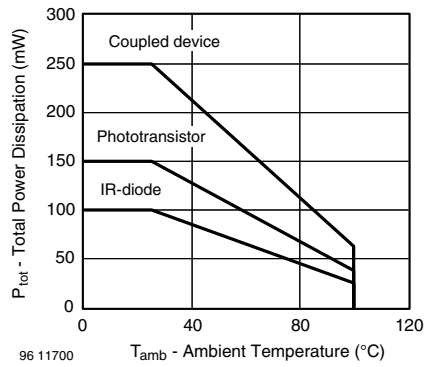


Figure 6. Total Power Dissipation vs. Ambient Temperature

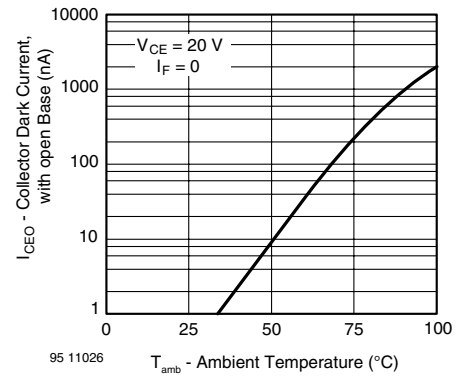


Figure 9. Collector Dark Current vs. Ambient Temperature

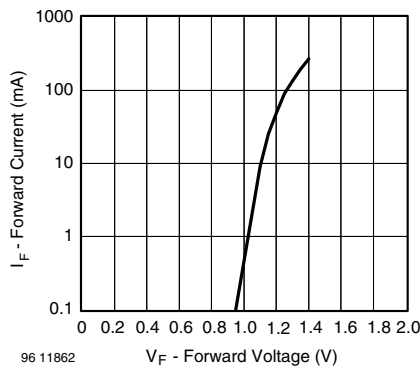


Figure 7. Forward Current vs. Forward Voltage

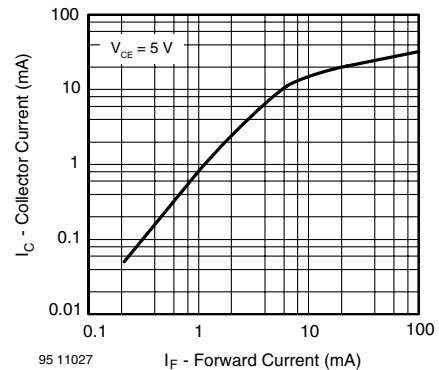


Figure 10. Collector Current vs. Forward Current

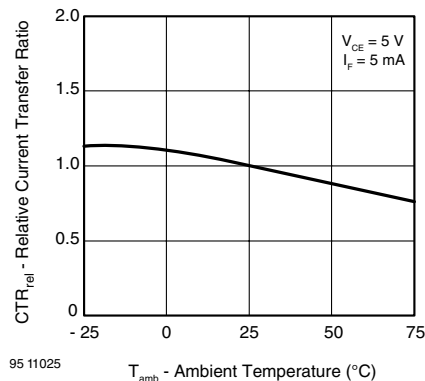


Figure 8. Relative Current Transfer Ratio vs. Ambient Temperature

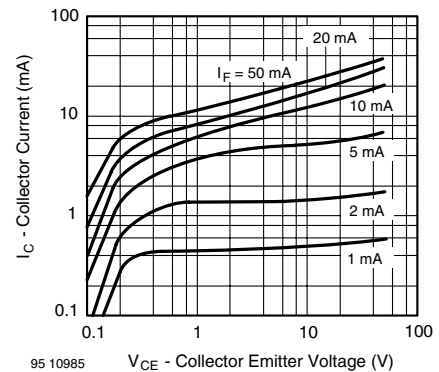


Figure 11. Collector Current vs. Collector Emitter Voltage

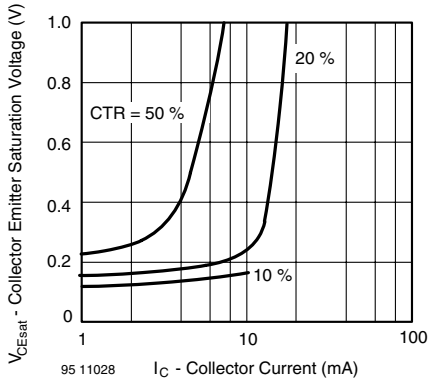


Figure 12. Collector Emitter Saturation Voltage vs. Collector Current

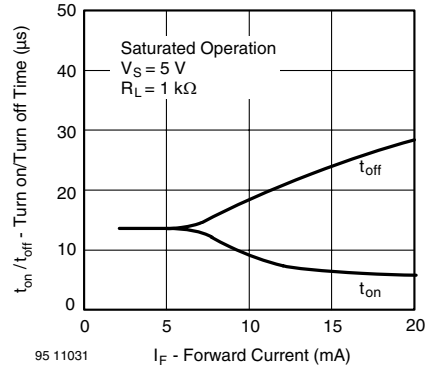


Figure 15. Turn on/off Time vs. Forward Current

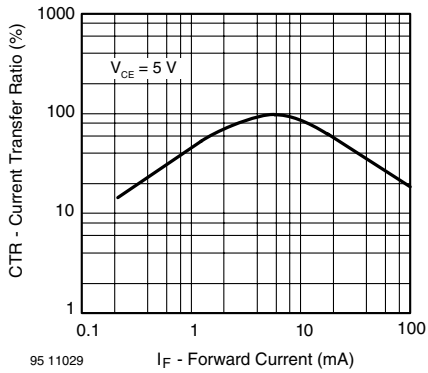


Figure 13. Current Transfer Ratio vs. Forward Current

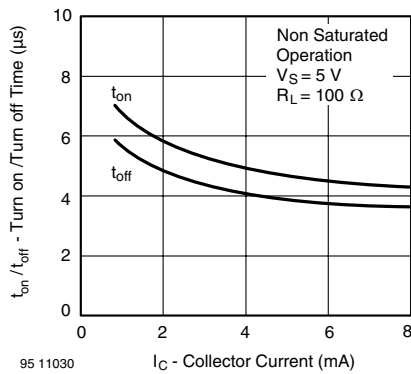
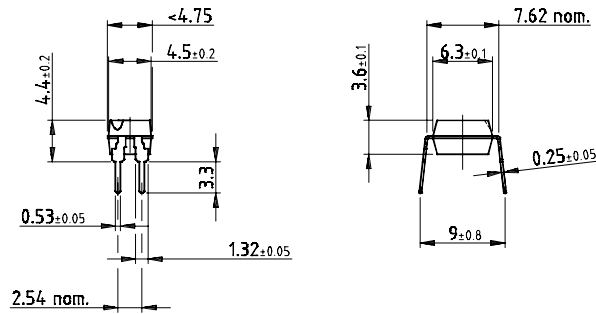
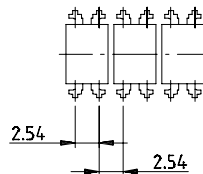
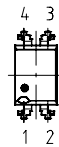


Figure 14. Turn on/off Time vs. Collector Current

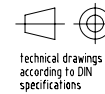
Package Dimensions in mm



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



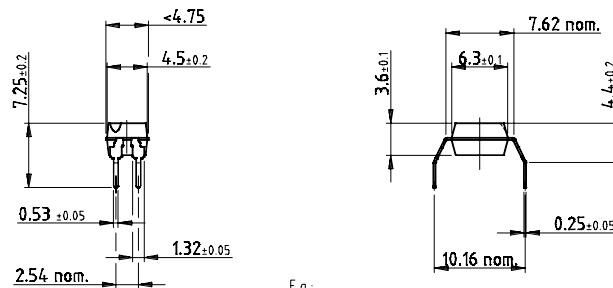
weight : ca 0.25g
creepage distance : > 6mm
air path : > 6mm
after mounting on PC board



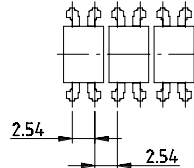
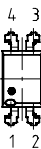
Drawing-No: 6.544-5302.03-4
Issue: 5; 20.03.02

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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



Drawing-No: 6.544-5303.03-4
Issue: 4; 20.03.02

14792

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



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