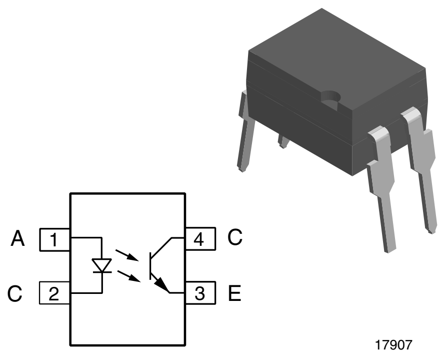
Optocoupler, Phototransistor Output, High Reliability, 5300 V_{RMS}, 110 °C Rated



DESCRIPTION

The 110 °C rated SFH617A (DIP) feature a high current transfer ratio, low coupling capacitance and high isolation voltage. These couplers have a GaAs infrared diode emitter, which is optically coupled to a silicon planar phototransistor detector, and is incorporated in a plastic DIP-4 package.
The coupling devices are designed for signal transmission between two electrically separated circuits.
The couplers are end-stackable with 2.54 mm spacing.
Creepage and clearance distances of > 8.0 mm are achieved with option 6. This version complies with IEC 60950 (DIN VDE 0805) for reinforced insulation up to an operation voltage of 400 V_{RMS} or DC. Specifications subject to change.

FEATURES

- Operating temperature from - 55 °C to + 110 °C
- Good CTR linearity depending on forward current
- Isolation test voltage, 5300 V_{RMS}
- High collector emitter voltage, V_{CEO} = 70 V
- Low saturation voltage
- Fast switching times
- Low CTR degradation
- Temperature stable
- Low coupling capacitance
- End stackable, 0.100" (2.54 mm) spacing
- High common mode interference immunity
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Pb-free
e3
RoHS
COMPLIANT

APPLICATIONS

- AC adapter
- SMPS
- PLC
- Factory automation
- Game consoles

AGENCY APPROVALS

- UL1577, file no. E52744 system code H or J, double protection
- CSA 93751
- DIN EN 60747-5-2 (VDE 0884)/DIN EN 60747-5-5 pending available with option 1
- BSI IEC 60950; IEC 60065
- FIMKO

ORDER INFORMATION	
PART	REMARKS
SFH617A-1	CTR 40 to 80 %, DIP-4
SFH617A-2	CTR 63 to 125 %, DIP-4
SFH617A-3	CTR 100 to 200 %, DIP-4
SFH617A-4	CTR 160 to 320 %, DIP-4
SFH617A-1X006	CTR 40 to 80 %, DIP-4 400 mil
SFH617A-2X006	CTR 63 to 125 %, DIP-4 400 mil
SFH617A-2X009	CTR 63 to 125 %, SMD-4
SFH617A-3X006	CTR 100 to 200 %, DIP-4 400 mil
SFH617A-3X007	CTR 100 to 200 %, SMD-4
SFH617A-4X006	CTR 160 to 320 %, DIP-4 400 mil

Note
For additional information on the available options refer to option information.

ABSOLUTE MAXIMUM RATINGS (1)				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
INPUT				
Reverse voltage		V_R	6.0	V
DC forward current		I_F	60	mA
Surge forward current	t ≤ 10 µs	I_{FSM}	2.5	A
Derate linearly from 25 °C			0.95	mW/°C
OUTPUT				
Collector emitter voltage		V_{CE}	70	V
Emitter collector voltage		V_{EC}	7.0	V
Collector current		I_C	50	mA
	t ≤ 1.0 ms	I_C	100	mA
Derate linearly from 25 °C			1.54	mW/°C
COUPLER				
Isolation test voltage between emitter and detector, refer to climate DIN 40046, part 2, Nov. 74		V_{ISO}	5300	V_{RMS}
Isolation resistance	V_{IO} = 500 V, T_{amb} = 25 °C	R_{IO}	≥ 10^{12}	Ω
	V_{IO} = 500 V, T_{amb} = 100 °C	R_{IO}	≥ 10^{11}	Ω
Storage temperature range		T_{stg}	- 55 to + 150	°C
Ambient temperature range		T_{amb}	- 55 to + 110	°C
Soldering temperature (2)	max. 10 s, dip soldering distance to seating plane ≥ 1.5 mm	T_{sld}	260	°C

Notes

(1) T_{amb} = 25 °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 ratings for extended periods of the time can adversely affect reliability.

(2) Refer to reflow profile for soldering conditions for surface mounted devices (SMD). Refer to wave profile for soldering conditions for through hole devices (DIP).

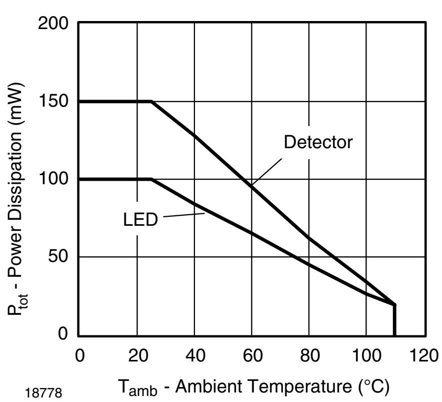


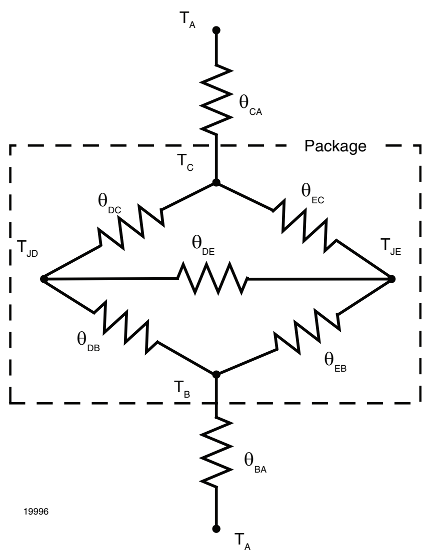
Fig. 1 - Permissible Power Dissipation vs. Ambient Temperature

THERMAL CHARACTERISTICS [1]				
PARAMETER	**TEST CONDITION**	**SYMBOL**	**VALUE**	**UNIT**
LED power dissipation	at 25 °C	P_{diss}	100	mW
Output power dissipation	at 25 °C	P_{diss}	150	mW
Maximum LED junction temperature		T_{jmax}	125	°C
Maximum output die junction temperature		T_{jmax}	125	°C
Thermal resistance, junction emitter to board		θ_{EB}	173	°C/W
Thermal resistance, junction emitter to case		θ_{EC}	149	°C/W
Thermal resistance, junction detector to board		θ_{DB}	111	°C/W
Thermal resistance, junction detector to case		θ_{DC}	127	°C/W
Thermal resistance, junction emitter to junction detector		θ_{ED}	95	°C/W
Thermal resistance, board to ambient [2]		θ_{BA}	195	°C/W
Thermal resistance, case to ambient [2]		θ_{CA}	3573	°C/W

Notes

(1) 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.

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



ELECTRICAL CHARACTERISTICS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Forward voltage	I_F = 60 mA		V_F		1.25	1.65	V
Reverse current	V_R = 6.0 V		I_R		0.01	10	µA
Capacitance	V_R = 0 V, f = 1.0 MHz		C_O		13		pF
OUTPUT							
Collector emitter capacitance	V_{CE} = 5.0 V, f = 1.0 MHz		C_{CE}		5.2		pF
Collector emitter leakage current	V_{CE} = 10 V	SFH617A-1	I_{CEO}		2.0	50	nA
		SFH617A-2	I_{CEO}		2.0	50	nA
		SFH617A-3	I_{CEO}		5.0	100	nA
		SFH617A-4	I_{CEO}		5.0	100	nA

ELECTRICAL CHARACTERISTICS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
COUPLER							
Collector emitter saturation voltage	I_F = 10 mA, f = 1.0 MHz		V_{CEsat}	0.4	0.25		V
Coupling capacitance			C_C		0.4		pF

Note

T_{amb} = 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.

CURRENT TRANSFER RATIO							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
I_C/I_F	I_F = 10 mA, V_{CE} = 5.0 V	SFH617A-1	CTR	40		80	%
		SFH617A-2	CTR	63		125	%
		SFH617A-3	CTR	100		200	%
		SFH617A-4	CTR	160		320	%
	I_F = 1.0 mA, V_{CE} = 5.0 V	SFH617A-1	CTR	13	30		%
		SFH617A-2	CTR	22	45		%
		SFH617A-3	CTR	34	70		%
		SFH617A-4	CTR	56	90		%

SWITCHING CHARACTERISTICS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
NON-SATURATED							
Turn-on time	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω		t_{on}		3.0		µs
Rise time	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω		t_r		2.0		µs
Turn-off time	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω		t_{off}		2.3		µs
Fall time	I_F = 10 mA, V_{CC} = 5.0 V, R_L = 75 Ω		t_f		2.0		µs
Cut-off frequency	I_F = 10 mA, V_{CC} = 5.0 V		f_{ctr}		250		kHz
SATURATED							
Turn-on time	I_F = 20 mA	SFH617A-1	t_{on}		3.0		µs
	I_F = 10 mA	SFH617A-2	t_{on}		4.2		µs
		SFH617A-3	t_{on}		4.2		µs
	I_F = 5.0 mA	SFH617A-4	t_{on}		6.0		µs
Rise time	I_F = 20 mA	SFH617A-1	t_r		2.0		µs
	I_F = 10 mA	SFH617A-2	t_r		3.0		µs
		SFH617A-3	t_r		3.0		µs
	I_F = 5.0 mA	SFH617A-4	t_r		4.6		µs
SATURATED							
Turn-off time	I_F = 20 mA	SFH617A-1	t_{off}		18		µs
	I_F = 10 mA	SFH617A-2	t_{off}		23		µs
		SFH617A-3	t_{off}		23		µs
	I_F = 5.0 mA	SFH617A-4	t_{off}		25		µs
Fall time	I_F = 20 mA	SFH617A-1	t_f		11		µs
	I_F = 10 mA	SFH617A-2	t_f		14		µs
		SFH617A-3	t_f		14		µs
	I_F = 5.0 mA	SFH617A-4	t_f		15		µs

SAFETY AND INSULATION RATINGS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Climatic classification (according to IEC 68 part 1)				55/100/21		
Comparative tracking index		CTI	175		399	
V_{IOTM}			10000			V
V_{IORM}			890			V
P_{SO}					400	mW
I_{SI}					275	mA
T_{SI}					175	°C
Creepage distance	standard DIP-4		7			mm
Clearance distance	standard DIP-4		7			mm
Creepage distance	400 mil DIP-4		8			mm
Clearance distance	400 mil DIP-4		8			mm
Insulation thickness, reinforced rated	per IEC 60950 2.10.5.1		0.4			mm

Note

As per IEC 60747-5-2, § 7.4.3.8.1, this optocoupler is suitable for "safe electrical insulation" only within the safety ratings. Compliance with the safety ratings shall be ensured by means of protective circuits.

TYPICAL CHARACTERISTICS

T_{amb} = 25 °C, unless otherwise specified

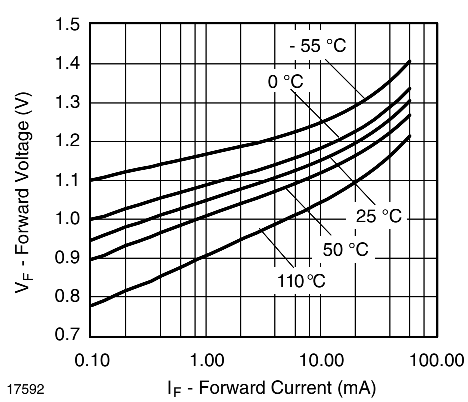


Fig. 2 - Forward Voltage vs. Forward Current

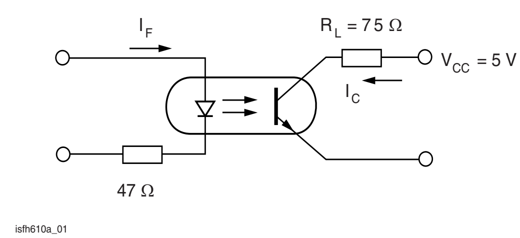


Fig. 3 - Linear Operation (without Saturation)

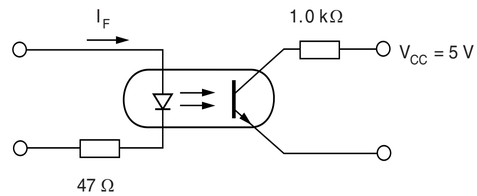


Fig. 4 - Linear Operation (With Saturation)

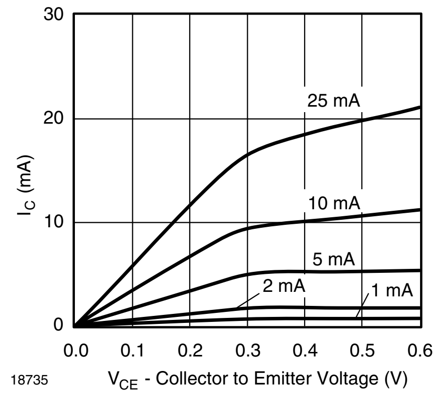


Fig. 7 - Normalized Current vs. Collector Emitter Saturation Voltage

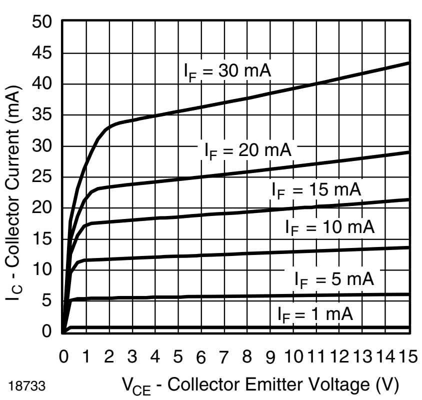


Fig. 5 - Collector Current vs. Collector Emitter Voltage

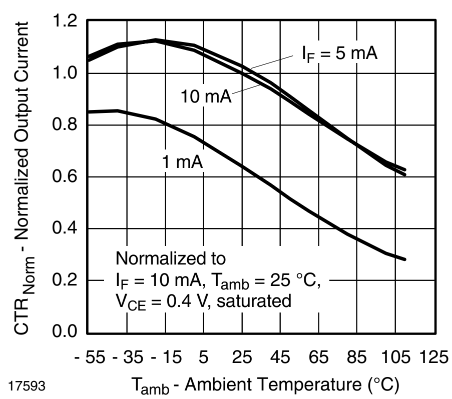


Fig. 8 - Normalized Current Transfer Ratio vs. Ambient Temperature

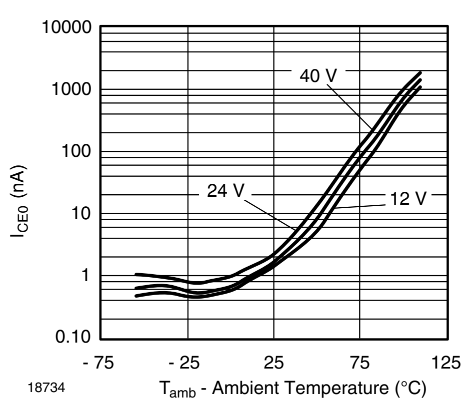


Fig. 6 - Collector to Emitter Dark Current vs. Ambient Temperature

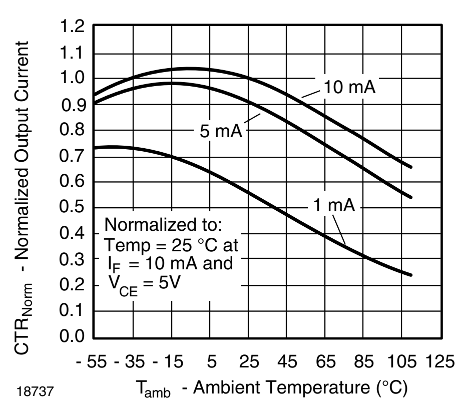


Fig. 9 - Normalized CTR vs. Temperature

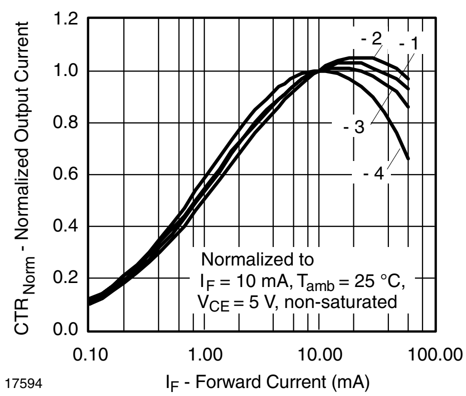


Fig. 10 - Normalized CTR vs. Forward Current

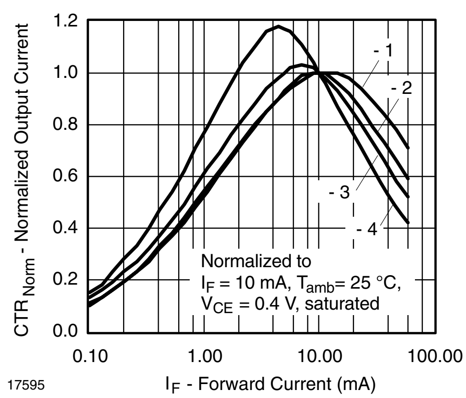


Fig. 11 - Normalized CTR vs. Forward Current

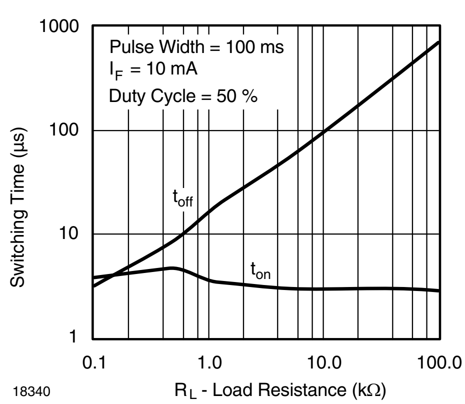


Fig. 12 - Forward Resistance vs. Forward Current

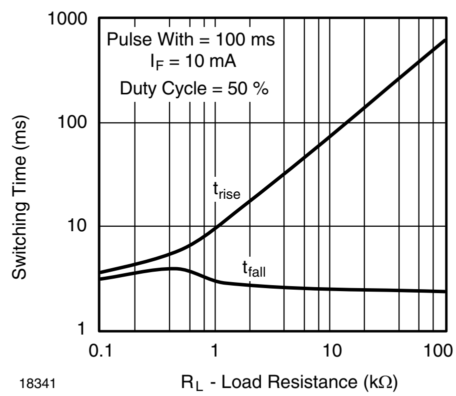
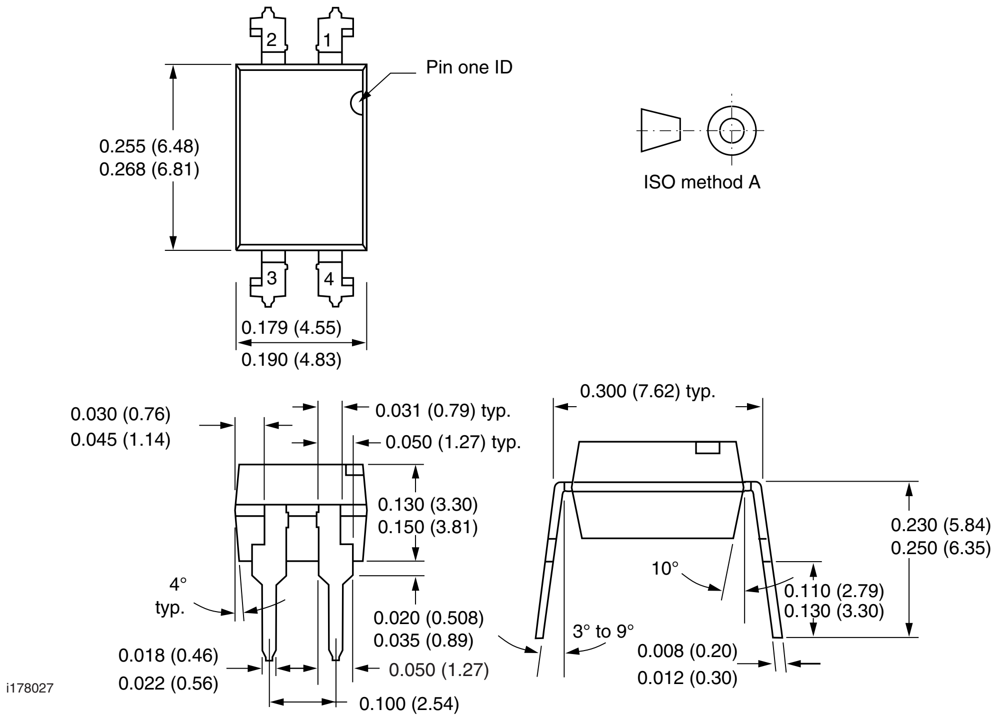
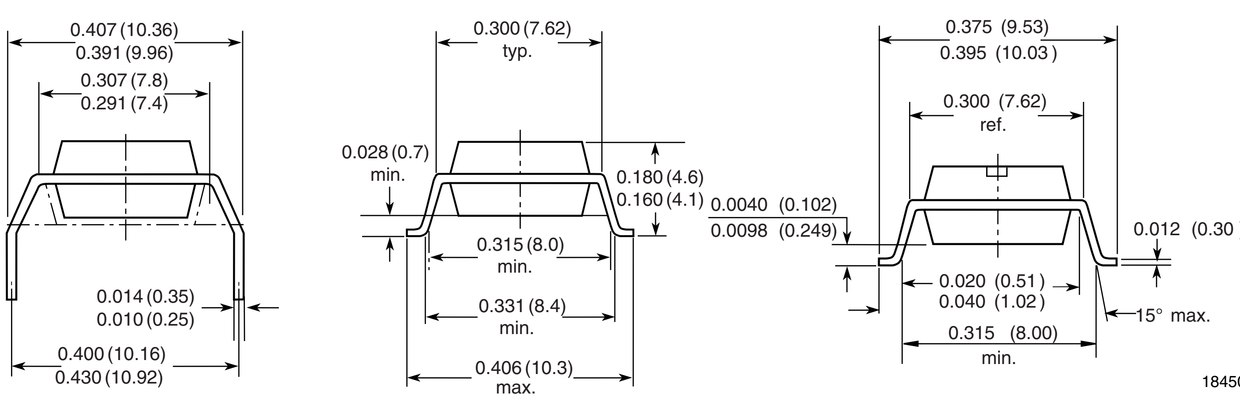


Fig. 13 - Forward Resistance vs. Forward Current

PACKAGE DIMENSIONS in inches (millimeters)



Option 6 **Option 7** **Option 9**



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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).

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

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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.

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