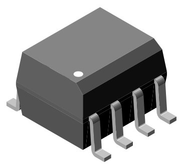
Optocoupler, Phototransistor Output, Low Input Current, with Base Connection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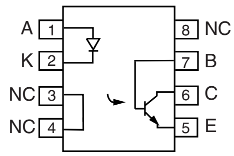


DESCRIPTION

The VO215AT, VO216AT, VO217AT are optically coupled pairs with a Gallium Arsenide infrared LED and a silicon NPN phototransistor. Signal information, including a DC level, can be transmitted by the device while maintaining a high degree of electrical isolation between input and output.
The high CTR at low input current is designed for low power consumption requirements such as CMOS microprocessor interfaces.

FEATURES

- High current transfer ratio
- Isolation test voltage, 4000 V_{RMS}
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

Pb-free
e3
RoHS COMPLIANT

AGENCY APPROVALS

- UL1577, file no. E52744 system code Y
- CUL - file no. E52744, equivalent to CSA bulletin 5A
- DIN EN 60747-5-5 (VDE 0884) available with option 1

ORDER INFORMATION

PART	REMARKS
VO215AT	CTR > 20 %, SOIC-8
VO216AT	CTR > 50 %, SOIC-8
VO217AT	CTR > 100 %, SOIC-8

ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
INPUT				
Peak reverse voltage		V_R	6	V
Peak forward current	1 µs, 300 pps	I_{FM}	1	A
Forward continuous current		I_F	60	mA
Power dissipation		P_{diss}	90	mW
Derate linearly from 25 °C			1.2	mW/°C
OUTPUT				
Collector emitter breakdown voltage		BV_{CEO}	30	V
Emitter collector breakdown voltage		BV_{ECO}	7	V
Collector base breakdown voltage		BV_{CBO}	70	V
$I_{Cmax. DC}$		$I_{Cmax. DC}$	50	mA
$I_{Cmax.}$	t < 1 ms	$I_{Cmax.}$	100	mA
Power dissipation		P_{diss}	150	mW
Derate linearly from 25 °C			2	mW/°C
COUPLER				
Isolation test voltage	1 s	V_{ISO}	4000	V_{RMS}
Total package dissipation	LED and detector	P_{tot}	240	mW
Derate linearly from 25 °C			3.2	mW/°C
Storage temperature		T_{stg}	- 40 to + 150	°C
Operating temperature		T_{amb}	- 40 to + 100	°C
Soldering time	at 260 °C		10	s

Note
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.

ELECTRICAL CHARACTERISTCS							
PARAMETER	**TEST CONDITION**	**PART**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
INPUT							
Forward voltage	I_F = 1 mA		V_F		1	1.5	V
Reverse current	V_R = 6 V		I_R		0.1	100	µA
Capacitance	V_R = 0 V		C_O		13		pF
OUTPUT							
Collector emitter breakdown voltage	I_C = 100 µA		BV_{CEO}	30			V
Emitter collector breakdown voltage	I_C = 10 µA		BV_{ECO}	7			V
Collector base breakdown voltage	I_C = 100 µA		BV_{CBO}	100			V
Collector base current			I_{CBO}			1	nA
Emitter base current			I_{EBO}			1	nA
Dark current collector emitter	V_{CE} = 10 V, I_F = 0 A		I_{CEO}		5	50	nA
Collector emitter capacitance	V_{CE} = 0		C_{CE}		10		pF
Saturation voltage, collector emitter	I_F =1 mA, I_C = 0.1 mA		V_{CEsat}			0.4	V
COUPLER							
Capacitance (input to output)			C_{IO}		0.5		pF

Note

T_{amb} = 25 °C, unless otherwise specified.
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**
DC current transfer ratio	I_F = 1 mA, V_{CE} = 5 V	VO215AT	CTR_{DC}	20	50		%
		VO216AT	CTR_{DC}	50	80		%
		VO217AT	CTR_{DC}	100	130		%

SWITCHING CHARACTERISTICS						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Turn-on time	I_C = 2 mA, R_L = 100 Ω, V_{CC} = 10 V	t_{on}		3		µs
Turn-off time	I_C = 2 mA, R_L = 100 Ω, V_{CC} = 10 V	t_{off}		3		µs
Rise time	I_C = 2 mA, R_L = 100 Ω, V_{CC} = 10 V	t_r		3		µs
Fall time	I_C = 2 mA, R_L = 100 Ω, V_{CC} = 10 V	t_f		2		µs

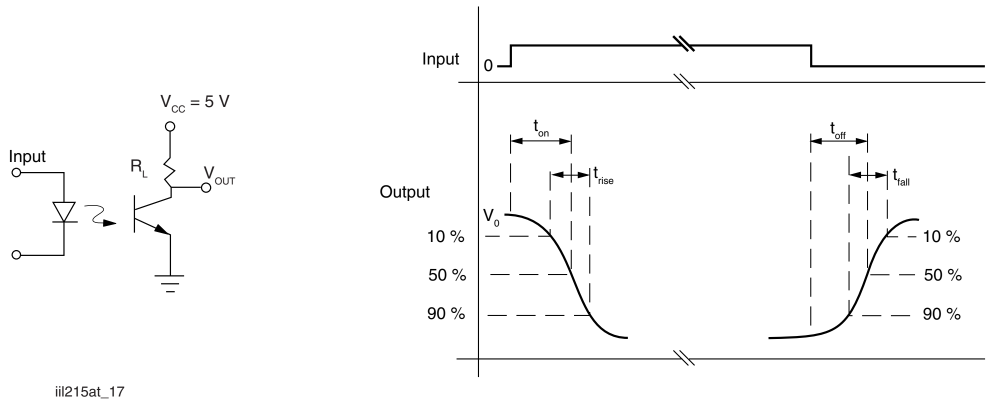


Fig. 1 - Switching Test Circuit

COMMON MODE TRANSIENT IMMUNITY						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Common mode transient immunity at logic high	V_{CM} = 1000 V_{P-P}, R_L = 1 kΩ, I_F = 0 mA	$\lvert C_{MH} \rvert$		5000		V/µs
Common mode transient immunity at logic low	V_{CM} = 1000 V_{P-P}, R_L = 1 kΩ, I_F = 10 mA	$\lvert C_{ML} \rvert$		5000		V/µs

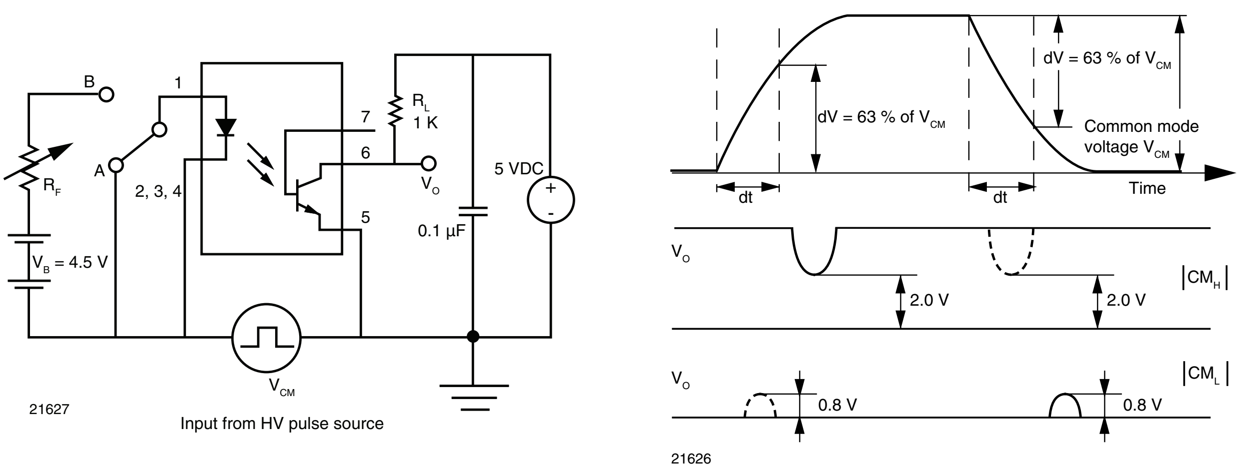


Fig. 2 - Test Circuit for Common Mode Transient Immunity

SAFETY AND INSULATION RATINGS						
PARAMETER	**TEST CONDITION**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
Climatic classification (according to IEC 68 part 1)				40/100/21		
Polution degree				2		
Comparative tracking index		CTI	175		399	
Isolation test voltage	1 s	V_{ISO}	4000			V_{RMS}
Peak transient overvoltage		V_{IOTM}	6000			V
Peak insulation voltage		V_{IORM}	560			V
Resistance (input to output)		R_{IO}		100		GΩ
Safety rating - power output		P_{SO}			350	mW
Safety rating - input current		I_{SI}			150	mA
Safety rating - temperature		T_{SI}			165	°C
External creepage distance			4			mm
External clearance distance			4			mm
Internal creepage distance			3.3			mm
Insulation thickness			0.2			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

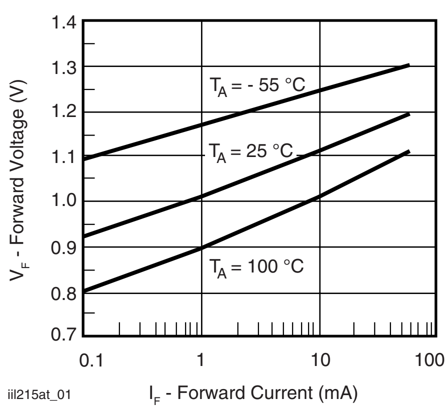


Fig. 3 - Forward Voltage vs. Forward Current

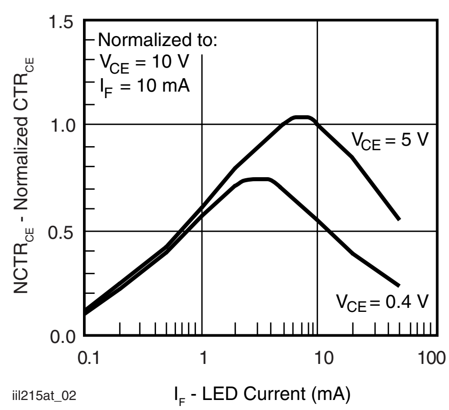


Fig. 4 - Normalized Non-Saturated and Saturated CTR_{CE} vs. LED Current

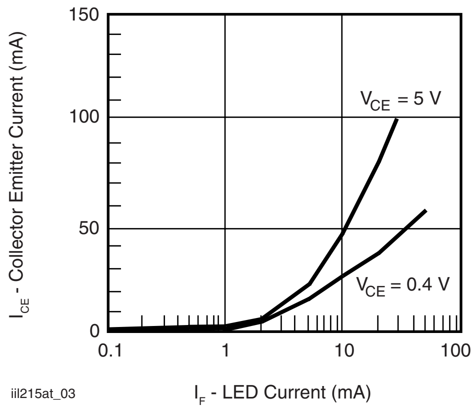


Fig. 5 - Collector Emitter Current vs. LED Current

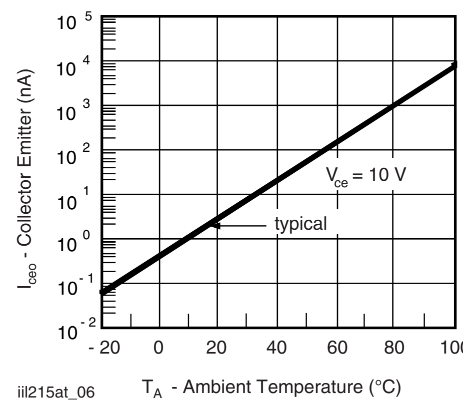


Fig. 8 - Collector Emitter Leakage Current vs.Temperature

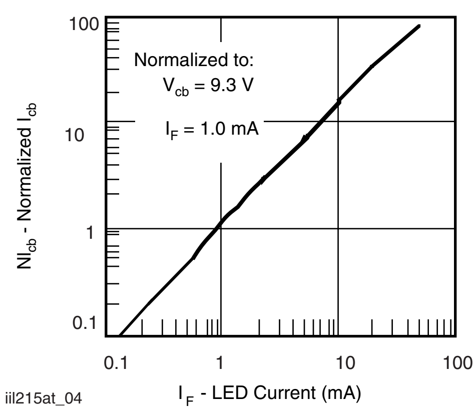


Fig. 6 - Normalized Collector Base Photocurrent vs. LED Current

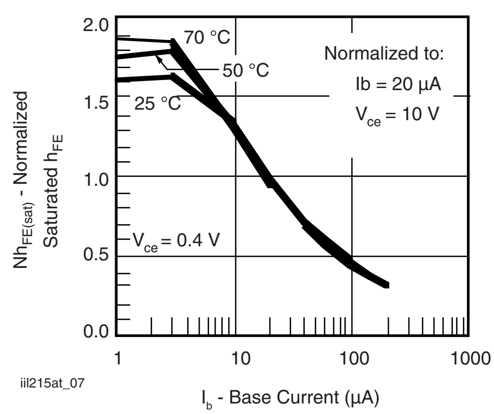


Fig. 9 - Normalized Saturated h_{FE} vs. Base Current and Temperature

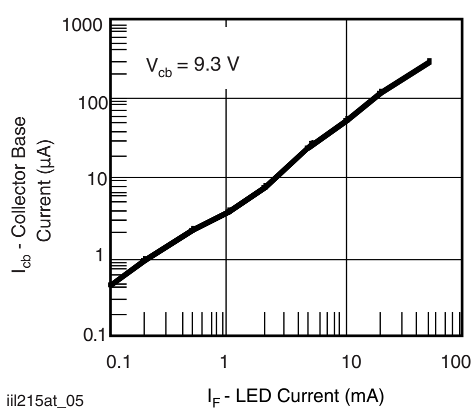


Fig. 7 - Collector Base Photocurrent vs. LED Current

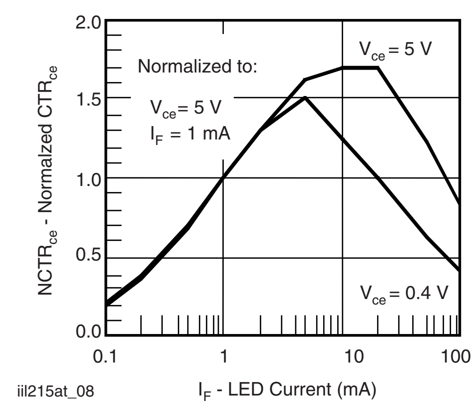


Fig. 10 - Normalized Non-Saturated and Saturated CTR_{CE} vs. LED Current

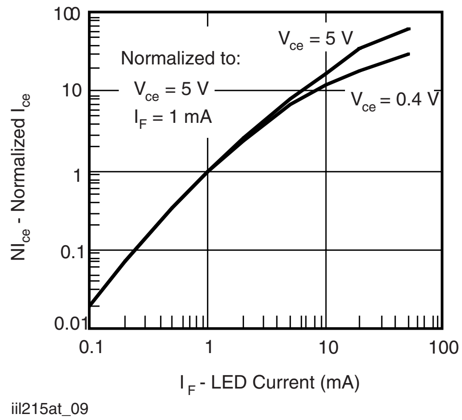


Fig. 11 - Normalized Non-Saturated and Saturated Collector Emitter Current vs. LED Current

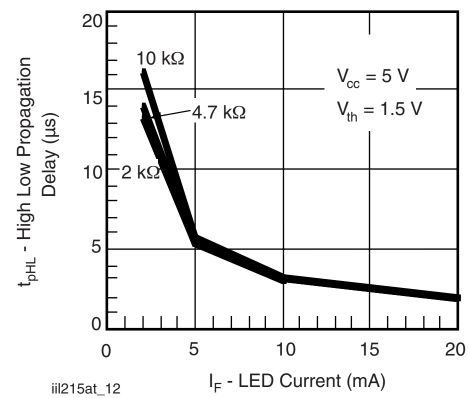


Fig. 14 - High to Low Propagation Delay vs. LED Current and Load Resistor

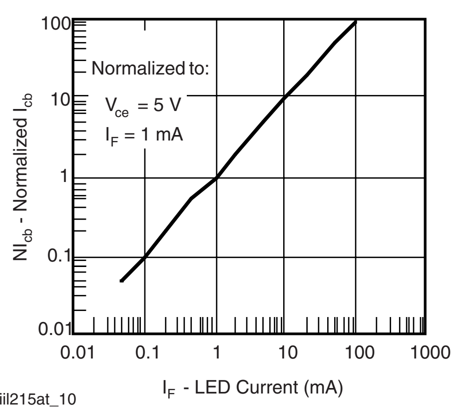


Fig. 12 - Normalized Collector Base Photocurrent vs. LED Current

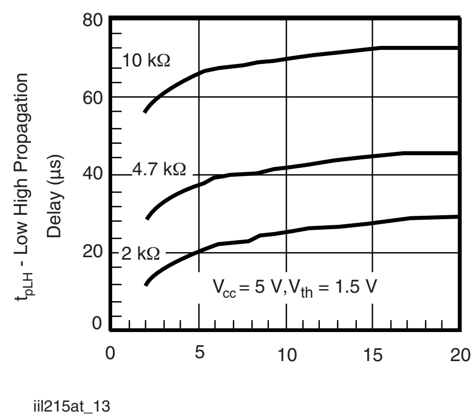


Fig. 15 - Low to High Propagation Delay vs. LED Current and Load Resistor

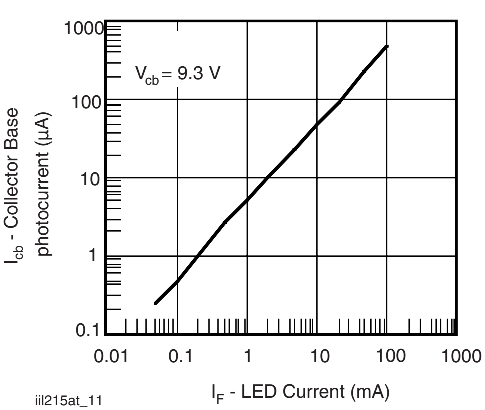


Fig. 13 - Collector Base Photocurrent vs. LED Current

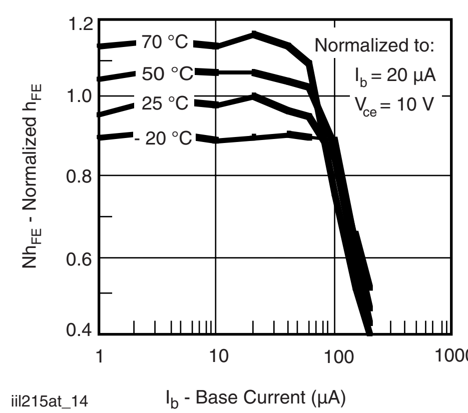


Fig. 16 - Normalized Non-Saturated h_{FE} vs. Base Current and Temperature

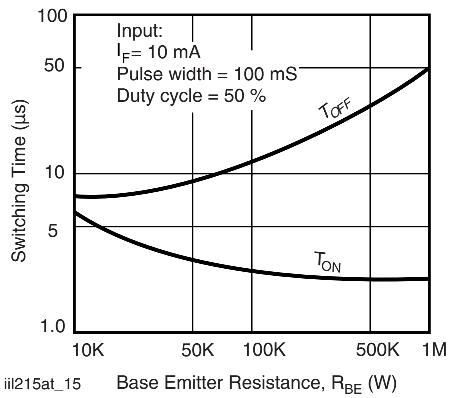


Fig. 17 - Typical Switching Characteristics vs. Base Resistance (Saturated Operation)

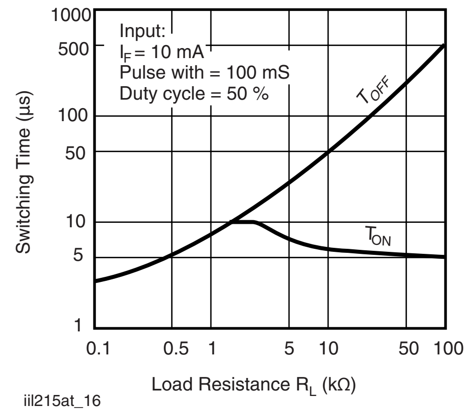
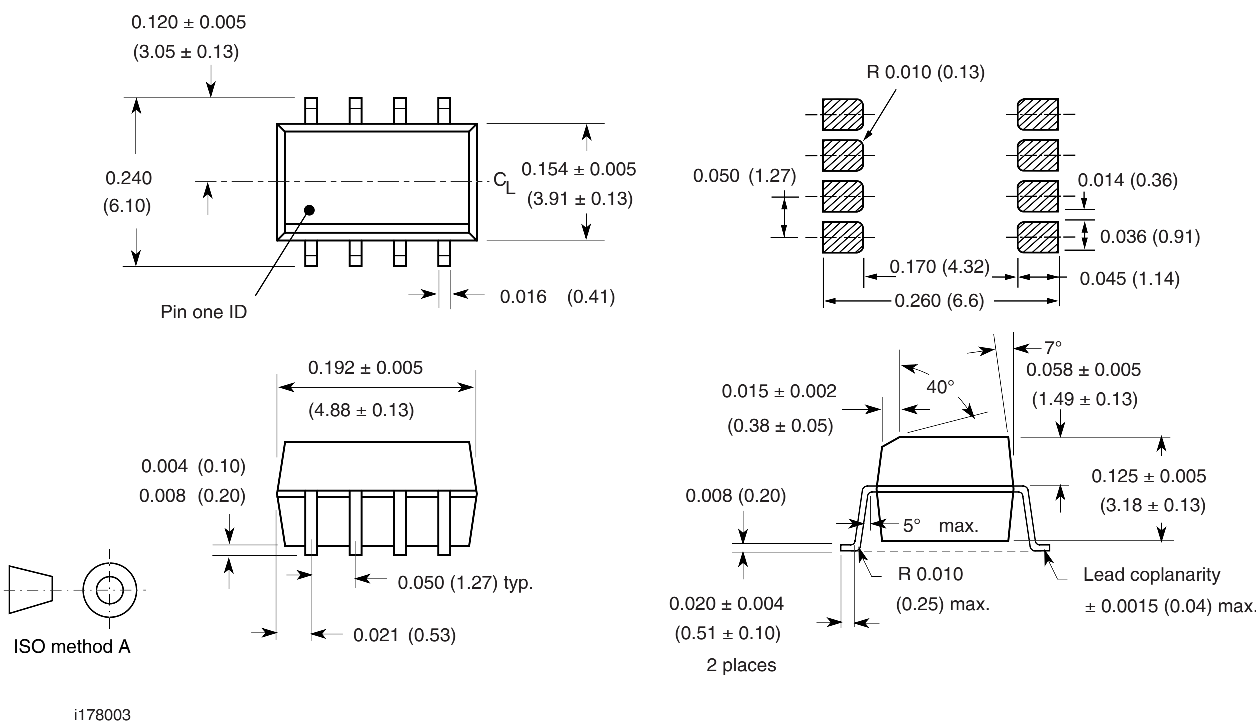


Fig. 18 - Typical Switching Times vs. Load Resistance

PACKAGE DIMENSIONS in inches (millimeters)



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.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

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