



## Integrated Low Profile Transceiver Module for Telecom Applications – IrDA Standard



### Description

The miniaturized TFDU4203 is an ideal transceiver for applications in telecommunications like mobile phones and pagers. The device is mechanically designed for lowest profile with a height of only 2.8 mm. The infrared transceiver is compatible to the IrDA® IrPHY specification version 1.3 up to a data rate of 115 kbit/s. At operating voltages up to 3.3 V the transceiver can be operated without external current limiting resistor to achieve full SIR compliance (range > 1 m in full  $\pm 15^\circ$  cone).

The TFDU4403 transceiver use the same chipset as TFDU4202. But the split power supply feature has been given up in favor of a shut down function. The output intensity is adjustable by an external resistor to save current consumption in low power applications.

### Features

- Package Dimension:  
L 7.3 mm x W 4.7 mm x H 2.8 mm
- Compatible to IrDA IrPHY 1.3 Standard
- SMD Side View
- Lowest Power Consumption  
65  $\mu$ A, Receive Mode, 0.01  $\mu$ A Shutdown Current
- Built-in Current Limitation
- Output Intensity Adjustable by External Resistor
- Wide Supply Voltage Range (2.4 V to 5.5 V)
- Operational down to 2.0 V
- Fewest External Components
- Eye Safety: Double Safety Measures:  
Limited Optical Output Pulse Duration  
Limited Optical Output Intensity
- Tri-State Output (Rxd)
- High EMI Immunity

### Applications

Mobile Phones, Pagers, Personal Digital Assistants (PDA), Handheld Battery Operated Equipment

### Package

TFDU4203  
 $\mu$ Face Side View  
weight: 0.10 g



### µFace SIR Selector Guide

Part Number	Main Feature	Rxd Output in Txd Mode	IRED Drive Capability	IrDA Compliance	Power Supply
TFDU4201	Low Power 20 cm/ 30 cm IrDA Standard SD pin	Optical Feedback**) (for e.g. self-test mode)	Internally current controlled, adjusted for $I_e > 4 \text{ mW/sr}$	Low Power SIR, pairs of TFDU4201 operate typically over a range of $> 70 \text{ cm}$ on axis	One power supply only, due to the very low current consumption no need for split power supply
TFDU4202	Split Power Supply Increased Range 70 cm	Quiet**) necessary for some WinCE <sup>®</sup> applications, Rxd grounded when $V_{CC} = 0 \text{ V}$	Internally current controlled to cover extended range of 70 cm. Current level can be reduced by an external resistor	Low Power SIR as e.g. TFDU4201, pairs of TFDU4202 operate typically up to full IrDA SIR distance $> 1 \text{ m}$	Split power supply*) can be used when operated at higher IRED current levels
TFDU4203	Similar to TFDU4201 with increased range 70 cm, SD pin	Quiet**) necessary for some WinCE <sup>®</sup> applications	Internally current controlled to cover extended range of 70 cm. Current level can be reduced by an external resistor	Low Power SIR as e.g. TFDU4201, pairs of TFDU4203 operate typically up to full IrDA SIR distance $> 1 \text{ m}$	One power supply only
TFDU4204	Similar to TFDU4202, Logic Input and Output Levels Adapted to 1.8 V Logic	Quiet**) necessary for some WinCE <sup>®</sup> applications, Rxd output is floating when supply voltage below 0.7 V	Internally current controlled to cover extended range of 70 cm. Current level can be reduced by an external resistor	Low Power SIR as e.g. TFDU4201, pairs of TFDU4204 operate typically up to full IrDA SIR distance $> 1 \text{ m}$	Split power supply*) can be used when operated at higher IRED current levels

\*) Split power supply: The receiver circuit only is connected to a regulated power supply. The high IRED current can be supplied by a less controlled power line or directly from the battery. That feature saves power supply costs. TELEFUNKEN introduced this feature as the world first with the 4000 series

\*\*) Depending on the designs different applications need an optical feedback for test purposes or must be quiet (e.g. in Windows CE<sup>®</sup> applications).

## Ordering Information

Part Number	Qty / Reel	Description
TFDU4203-TR1	750	Orientated in carrier tape for side view in mounting
TFDU4203-TR3	2250	Orientated in carrier tape for side view in mounting

## Functional Block Diagram

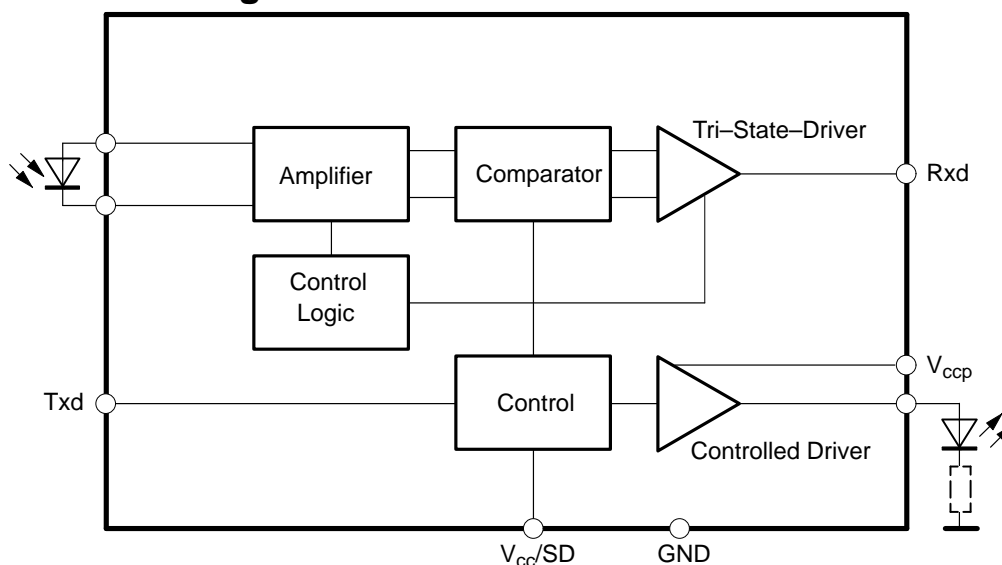


Figure 1. Functional Block Diagram

## Pin Description

Pin	Symbol	Description	I/O	Active
1	IRED GND	IRED Cathode, Ground		
2	IRED GND	IRED Cathode, Ground		
3	Rxd	Output, Received Data, tri-state, floating in shutdown mode (SD = High) Quiet during transmission	O	LOW
4	V <sub>CC</sub>	Supply Voltage		
5	GND	Ground		
6	GND	Ground		
7	Txd	Input, Transmit data	I	HIGH
8	SD	Shutdown	I	HIGH

## Absolute Maximum Ratings

Reference Point Pin 8, unless otherwise noted.

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit	Remarks
Supply Voltage Range		$V_{CC}$	-0.5		6	V	
Input Current					10	mA	all pins
Output Sink Current					25	mA	
Power Dissipation		$P_{tot}$			200	mW	
Junction Temperature		$T_J$			125	°C	
Ambient Temperature Range (Operating)		$T_{amb}$	-25		85	°C	
Storage Temperature Range		$T_{stg}$	-40		85	°C	
Soldering Temperature	$t = 20 \text{ s @ } 215^\circ\text{C}$			215	240	°C	see Vishay Telefunken IrDA Design Guide
Average IRED Current		$I_{IRED(DC)}$			125	mA	
Repetitive Pulsed IRED Current		$I_{IRED(RP)}$			500	mA	$<90 \mu\text{s}$ , $t_{on} < 20\%$
Transmitter Data Input Voltage		$V_{Txd}$	-0.5		$V_{CC}+0.5$	V	
Receiver Data Output Voltage		$V_{Rxd}$	-0.5		$V_{CC}+0.5$	V	
Virtual source size (TFDU4203 only)	Method: (1-1/e) encircled energy	$d$		2		mm	
Compatible to Class 1 operation of IEC 60825 or EN60825 with worst case IrDA SIR pulse pattern, 115.2 kbit/s							



## Electrical Characteristics

Tested for the following parameters ( $V_{CC} = 2.4\text{ V}$  to  $5.5\text{ V}$ ,  $25^\circ\text{C}$ , unless otherwise stated)

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit	Remarks
<b>Transceiver</b>							
Supported Data Rates	Base band		9.6		115.2	kbit/s	
Supply Voltage Range		$V_{CC}$	2.4		5.5	V	Operational Down to 2.0 V
Supply Current	$V_{CC} = 2.4\text{ V}$ to $5.5\text{ V}$ $E_e = 0$	$I_S$		65	80	$\mu\text{A}$	Receive Mode, full Temperature Range
	$V_{CC} = 2.4\text{ V}$ to $5.5\text{ V}$ 10 klx sunlight	$I_S$		70	90	$\mu\text{A}$	Receive Mode, full Temperature Range, no signal
	$V_{CC} = V_{CCP} = 2.7\text{ V}$ 115.2 kbit/s transmission	$I_S$		70	80	$\mu\text{A}$	Transmit Mode, full Temperature Range, or Receive Mode, Nose to Nose operation
Supply Current, @ $V_{CCP}$	Shutdown mode $V_{CC} = 0\text{ V}$	$I_{S\text{shutdown}}$		0.02	1 10	$\mu\text{A}$ nA	Entire Temperature Range $20^\circ\text{C}$
IRED Peak Current transmitting	$I_e = 40\text{ mW/sr}$ , no external resistor $V_{CCP} = 2.7\text{ V}$	$I_{Str}$			360	mA	SIR Standard
Transceiver "Power On" Settling Time				100	200	$\mu\text{s}$	Time from Switching on $V_{CCP}$ to Established Specified Operation

## Optoelectronic Characteristics

Tested for the following parameters ( $V_{CC} = 2.4 \text{ V}$  to  $5.5 \text{ V}$ ,  $25^\circ\text{C}$ , unless otherwise stated)

Parameter	Test Conditions	Symbol	Min.	Typ	Max	Unit	Remarks
<b>Receiver</b>							
Minimum Detection Threshold Irradiance (Logic High Receiver Input Irradiance)	$ \alpha  \leq \pm 15^\circ$ $V_{CC} = 2.4 \text{ V}$ to $5.5 \text{ V}$  $2.0 \text{ V}$	$E_{e, \min}$		25 (2.5)	40 (4)  70	$\text{mW/m}^2$ $\mu\text{W/m}^2$  $\text{mW/m}^2$	25° tested
Maximum Detection Threshold Irradiance	$ \alpha  \leq \pm 90^\circ$ $V_{CC} = 5 \text{ V}$	$E_{e, \max}$	3300 (330)	5000 (500)		$\text{W/m}^2$ $\mu\text{W/m}^2$	
	$ \alpha  \leq \pm 90^\circ$ $V_{CC} = 3 \text{ V}$	$E_{e, \max}$	8000 (800)	15000 (1500)		$\text{W/m}^2$ $\mu\text{W/m}^2$	
Logic Low Receiver Input Irradiance		$E_{e, \max, \text{low}}$			4 (0.4)	$\text{mW/m}^2$	
Output Voltage Rxd	Active	$V_{OL}$	0		0.5	V	C = 15 pF
	Non Active	$V_{OH}$	$V_{CC} - 0.5$			V	C = 15 pF
Output Current Rxd $V_{OL} < 0.5 \text{ V}$					4	mA	
Rise Time @Load: C = 15 pF, R = 2.2k		$t_r$	20		70	ns	
Fall Time @Load: C = 15 pF, R = 2.2k		$t_f$	20		70	ns	
Rxd Signal Electrical Output Pulse Width	2.4 kbit/s, Input Pulse Width 1.41 $\mu\text{s}$ to 3/16 of bit Duration	$t_p$	1.41		20	$\mu\text{s}$	
	115.2 kbit/s, Input Pulse Width 1.41 $\mu\text{s}$ to 3/16 of bit Duration	$t_p$	1.41		4.5	$\mu\text{s}$	
Output Delay Time (Rxd), Leading Edge Optical Input to Electrical Output	Output Level = $0.5 \times V_{CC}$ @ 40 $\text{mW/m}^2$	$t_{dl}$		1	2	$\mu\text{s}$	
Jitter, Leading Edge of Output Signal	Over a Period of 10 bit, 115.2 kbit/s	$t_j$			400	ns	
Output Delay Time (Rxd), Trailing Edge Optical Input to Electrical Output	Output Level = $0.5 \times V_{CC}$ 40 $\text{mW/m}^2$	$t_{dt}$			6.5	$\mu\text{s}$	
SD recovery time					100	$\mu\text{s}$	
Latency		$t_L$		100	200	$\mu\text{s}$	

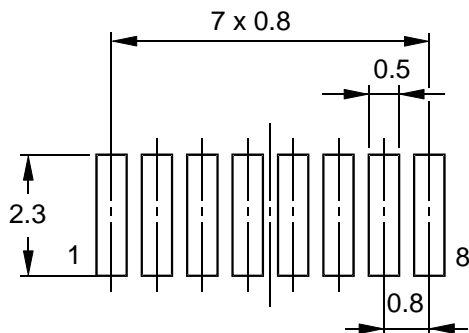


## Optoelectronic Characteristics (continued)

Tested for the following parameters ( $V_{CC} = 2.4\text{ V to }5.5\text{ V}$ ,  $-25^{\circ}\text{C to }85^{\circ}\text{C}$ , unless otherwise stated)

Parameter	Test Conditions	Symbol	Min.	Typ	Max.	Unit	Remarks
<b>Transmitter</b>							
Logic Low Transmitter Input Voltage		$V_{IL}(\text{Txd})$	-0.5		0.8	V	
Logic High Transmitter Input Voltage		$V_{IH}(\text{Txd})$	$0.8 \times V_{CC}$		$V_{CC} + 0.5$	V	
Logic Low Shutdown Input Voltage		$V_{IL}(\text{SD})$	0		0.8	V	
Logic High Shutdown Input Voltage		$V_{IH}(\text{SD})$	$0.8 \times V_{CC}$		$V_{CC} + 0.5$	V	
Optical Output Radiant Intensity, $ \alpha  \leq \pm 15^{\circ}$	$I_{F1} = 320\text{ mA}$ , Current Controlled by External Resistor	$I_e$	45			mW/sr	Voltage Range 2.7 V to 5.5 V
Peak Emission Wavelength		$\lambda_p$	880		900	nm	
Spectral Emission Bandwidth				60		nm	
Optical Rise/Falltime	115.2 kHz Square Wave Signal (duty cycle 1:1)				200	ns	
Optical Output Pulse Duration	Input Pulse Duration 1.6 $\mu\text{s}$		1.5	1.6	1.7	$\mu\text{s}$	
	Input Pulse Duration >25 $\mu\text{s}$				25	$\mu\text{s}$	Safety Protection
Output Radiant Intensity	Logic Low Level				0.04	$\mu\text{W/sr}$	
Overshoot, Optical					25	%	
Rising Edge Peak to Peak Jitter	Over a Period of 10 bits, Independent of Information Content	$t_j$			0.2	$\mu\text{s}$	

Recommended SMD Pad Layout



Transceiver leads to be soldered symmetrically on pads

Figure 2. Pad Layout

Current Derating Diagram

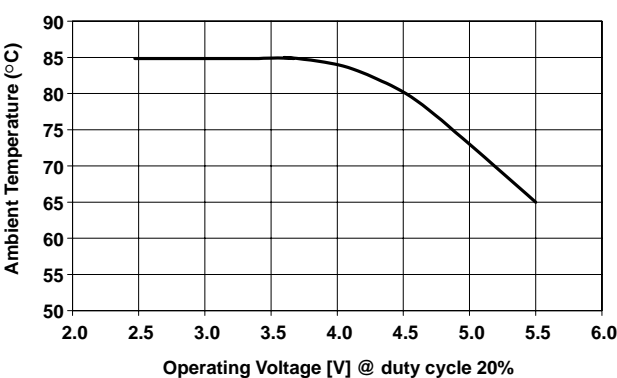


Figure 3. Derating Diagram

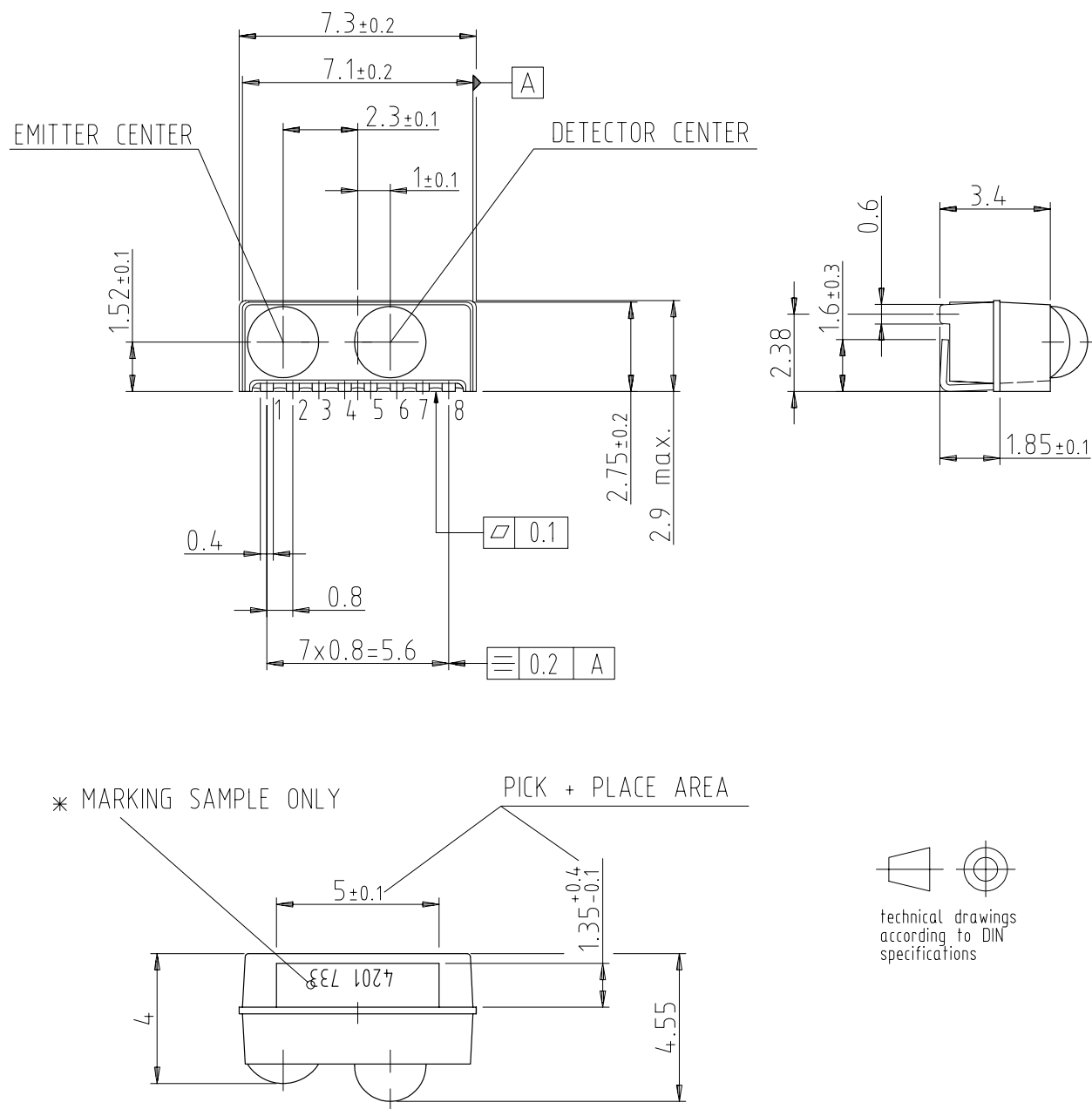
Figure 3 shows the maximum operating temperature when the device is operated without external current limiting resistor. A power dissipating resistor of 2Ω is recommended from the cathode of the IRED to Ground for supply voltages above 4 V. In that case the device can be operated up to 85°C, too

Table 1. Truth table

Inputs			Outputs	
SD	Txd	Optical input Irradiance mW/ m <sup>2</sup>	Rxd	Transmitter
high	x	x	floating	0
low	high	x	high	I <sub>e</sub>
low	high > 25 μs	x	high	0
low	low	< 4	high	0
low	low	> Min Detection Threshold Irradiance < Max Detection Threshold Irradiance	low	0
low	low	> Max Detection Threshold Irradiance	x	0



**TFDU4203--(Mechanical Dimensions)**



\* MARKING ORIENTATION  
180 DEGREES ALLOWED

Drawing-No.: 6.550-5185.01-4  
Issue: 3; 01.04.99

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## Appendix

### Application Hints

The TFDU4203 does not need any external components when operated at a “clean” power supply. In a more noisy ambient it is recommended to add a capacitor C1 (4.7  $\mu$ F Tantalum) and a resistor R1 ( $\leq 3 \Omega$ ) for noise suppression. In addition the capacitor is needed to prevent a pulse distortion when the power supply is not able to generate the peak currents or inductive wiring is used. A combination of a tantalum with a ceramics capacitor will be efficient to attenuate both, RF and LF if RF noise is present. The value is dependet on the power supply quality. A good choice is between 4.7  $\mu$ F and 10  $\mu$ F. In the circuit schematics, a resistor R2 is added for decreasing the internal power dissipation. For higher operating voltages the serial resistor is used reducing power dissipation inside the device. Without that resistor the allowed ambient temperature is limited to 75°C for  $V_{ccp} > 4$  V. With  $R2 = 4 \Omega$  as serial resistor that is increased to 85°C.

### Shut down

To shut down the TFDU4103 into a standby mode the SD pin has to be set active.

### Latency

The receiver is in specified conditions after the defined latency. In a UART related application after that time (typically 50  $\mu$ s) the receiver buffer of the UART must be cleared. Therefore the transceiver has to wait at least the specified latency after receiving the last bit before starting the transmission to be sure that the corresponding receiver is in a defined state.

For more application circuits, see IrDC Design Guide and TOIM3...-series data.

### Recommended Circuit Diagram

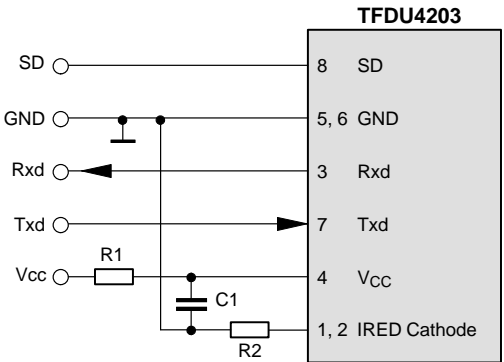


Table 1. Recommended Application Circuit Components

Component	Recommended Value	Vishay Part Number
C1	4.7 $\mu$ F, 16 V	293D 475X9 016B 2T



## **Revision History:**

A1.0, 13 /10/2000: First edition

## **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.

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Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay Telefunken products for any unintended or unauthorized application, the buyer shall indemnify Vishay Telefunken 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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