

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 up to a data rate of 115 kbit/s.

The transceiver can be operated without external current limiting resistor to achieve full SIR compliance (range > 1 m in full $\pm 15^\circ$ cone).

Features

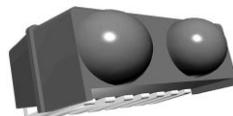
- Package Dimension:
L 7.1 mm x W 4.7 mm x H 2.8 mm
- Compatible to the latest IrDA IrPHY Standard
- CIR Remote Control Operation:
Typical Transmission Range 8 m Using Standard RC–Receivers. Receives RC–Commands with Typical Specified Sensitivity.
- SMD Side View
- Lowest Power Consumption
65 μ A, Receive Mode, 0.01 μ A Shutdown Current
- Built-in Current Limitation
- Output Intensity Adjustable beyond IrDA Low Power
- 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
IEC60825–1, 2001: Class 1
- Tri–State Output (Rxd)
- High EMI Immunity
- SD Pin

Applications

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

Package

TFDU4203
 μ Face Side View
weight: 0.10 g



µFace SIR Selector Guide

| Part Number | Main Feature | Rxd Output in Txd Mode | IREDD 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 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® 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 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® 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 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® 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 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® applications).

Ordering Information

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

Functional Block Diagram

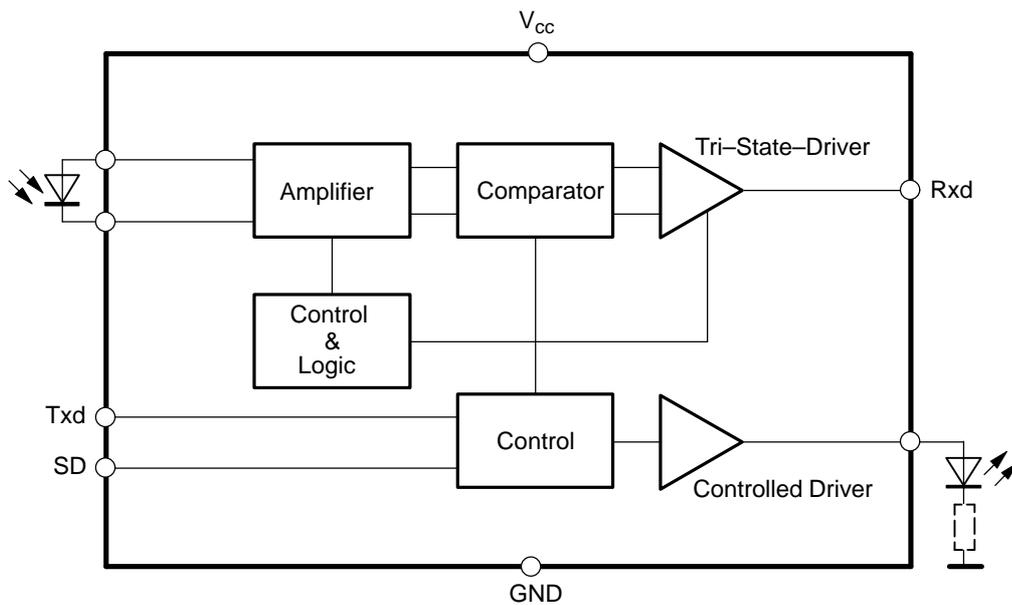


Figure 1. Functional Block Diagram

Pin Description

| Pin | Symbol | Description | I/O | Active |
|-----|-----------------|--|-----|--------|
| 1 | IREGND | IREGND Cathode, Ground | | |
| 2 | IREGND | IREGND Cathode, Ground | | |
| 3 | Rxd | Output, Received Data, Tri-state, Floating in Shutdown Mode (SD = High), Quiet during transmission | O | LOW |
| 4 | V _{CC} | 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 | | 100 | °C | |
| Soldering Temperature | t = 20 s @215°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 μ s, t_{on} <20% |
| Transmitter Data Input Voltage | | V_{Txd} | -0.5 | | 6 | V | |
| Receiver Data Output Voltage | | V_{Rxd} | -0.5 | | 6 | 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 V , , unless otherwise stated)

| Parameter | Test Conditions | Symbol | Min. | Typ. | Max. | Unit | Remarks |
|--------------------------------------|---|---------------|------|------|---------|---------------------|--|
| Transceiver | | | | | | | |
| 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 V $E_e = 0$ | I_S | | 65 | 100 | μA | Receive Mode, full Temperature Range |
| | $V_{CC} = 2.4\text{ V}$ to 5.5 V 10 klx sunlight | I_S | | 70 | 100 | μA | Receive Mode or Transmit Mode, full Temperature Range, No signal |
| | $V_{CC} = 2.7\text{ V}$ 115.2 kbit/s transmission | I_S | | 1 | | mA | Receive Mode, Nose to Nose operation |
| Supply Current, @ V_{CCP} | Shutdown mode $V_{CC} = 5.5\text{ V}$ | $I_{Sshdown}$ | | 0.02 | 1 10 | μA nA | Entire Temperature Range 20°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 | | | | | 1 | ms | Time from Switching on V_{CC} to Established Specified Operation |

Optoelectronic Characteristics

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

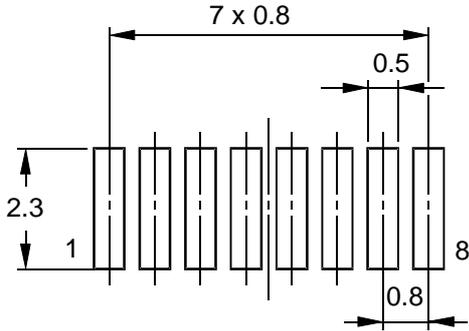
| Parameter | Test Conditions | Symbol | Min. | Typ | Max | Unit | Remarks |
|---|---|--------------------------|---------------|-----------------|------------|---------------------------------------|-------------|
| Receiver | | | | | | | |
| Minimum Detection Threshold Irradiance (Logic High Receiver Input Irradiance) | $ \alpha \leq \pm 15^{\circ}$ $V_{CC} = 2.4\text{ V to }5.5\text{ V}$ | $E_{e, \text{min}}$ | | 25 (2.5) | 50 (5) | mW/m^2 $\mu\text{W/cm}^2$ | 25°C tested |
| | 2.0 V | | | 50 | 100 | mW/m^2 | |
| Maximum Detection Threshold Irradiance | $ \alpha \leq \pm 90^{\circ}$ $V_{CC} = 5\text{ V}$ | $E_{e, \text{max}}$ | 3300 (330) | 5000 (500) | | W/m^2 mW/cm^2 | |
| | $ \alpha \leq \pm 90^{\circ}$ $V_{CC} = 3\text{ V}$ | $E_{e, \text{max}}$ | 8000 (800) | 15000 (1500) | | W/m^2 mW/cm^2 | |
| Logic Low Receiver Input Irradiance | | $E_{e, \text{max, low}}$ | | | 4 (0.4) | mW/m^2 $\mu\text{W/cm}^2$ | |
| 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 μs to 3/16 of bit Duration | t_p | 1.41 | | 20 | μs | |
| | 115.2 kbit/s, Input Pulse Width 1.41 μs to 3/16 of bit Duration | t_p | 1.41 | | 4.5 | μs | |
| Output Delay Time (Rxd), Leading Edge Optical Input to electrical output | Output Level = $0.5 \times V_{CC}$ @ 40 mW/m^2 | t_{dl} | | 1 | 2 | μs | |
| 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 mW/m^2 | t_{dt} | | | 6.5 | μs | |
| Power on time, SD recovery time | | | | 0.1 | 1 | ms | |
| Latency | | t_L | | 100 | 200 | μs | |

**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 |
|--|--|----------------------|---------------------|-----|----------------------|------------------|---------------------------------|
| Transmitter | | | | | | | |
| Logic Low Shutdown Input Voltage *) | | $V_{IL}(\text{Txd})$ | -0.5 | | $0.15 \times V_{CC}$ | V | |
| Logic High Shutdown Input Voltage *) | | $V_{IH}(\text{Txd})$ | $0.8 \times V_{CC}$ | | 6 | V | |
| Logic Low Transmitter Input Voltage *) | | $V_{IL}(\text{Txd})$ | 0.5 | | $0.81 \times V_{CC}$ | V | |
| Logic High Transmitter Input Voltage *) | | $V_{IH}(\text{Txd})$ | $0.8 \times V_{CC}$ | | 6 | V | |
| Optical Output Radiant Intensity, $ \alpha \leq \pm 15^{\circ}$ | $I_{F1} = 320\text{ mA}$, Internally Current Controlled **) | I_e | 45 | | | mW/sr | Voltage Range 2.7 V to 5.5 V *) |
| Peak Emission Wavelength | | λ_p | 880 | | 900 | nm | |
| Spectral Emission Bandwidth | | | | 40 | | 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 μs | | 1.5 | 1.6 | 1.7 | μs | |
| 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 | μs | |

*) Recommended logic levels for minimum shutdown current. The CMOS decision level is $0.5 \times V_{CC}$ **) Add external resistor for $V_{CC} > 4\text{ V}$ to prevent thermal overload, see Fig. 3

Recommended SMD Pad Layout



Transceiver leads to be soldered symmetrically on pads

Figure 2. Pad Layout

Temperature Derating

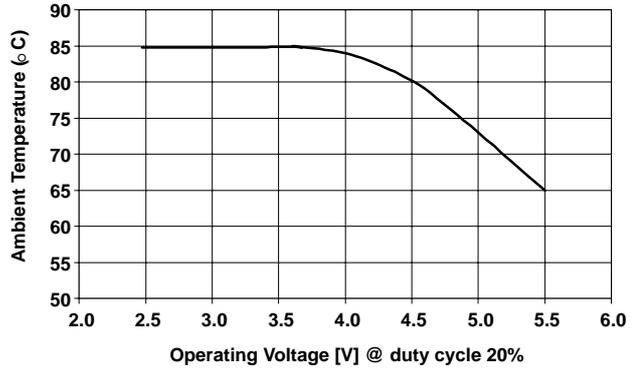
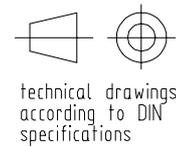
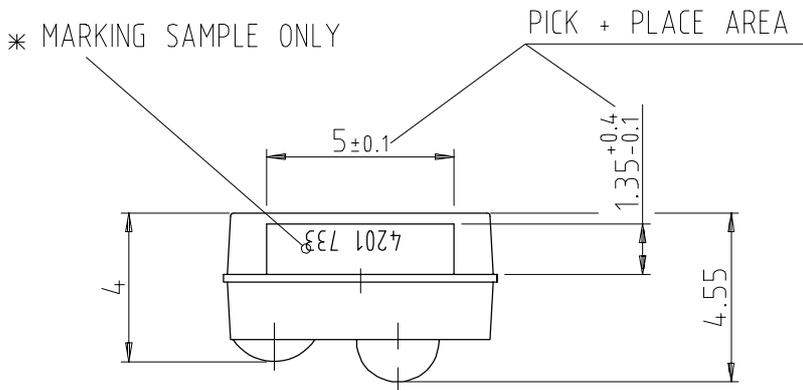
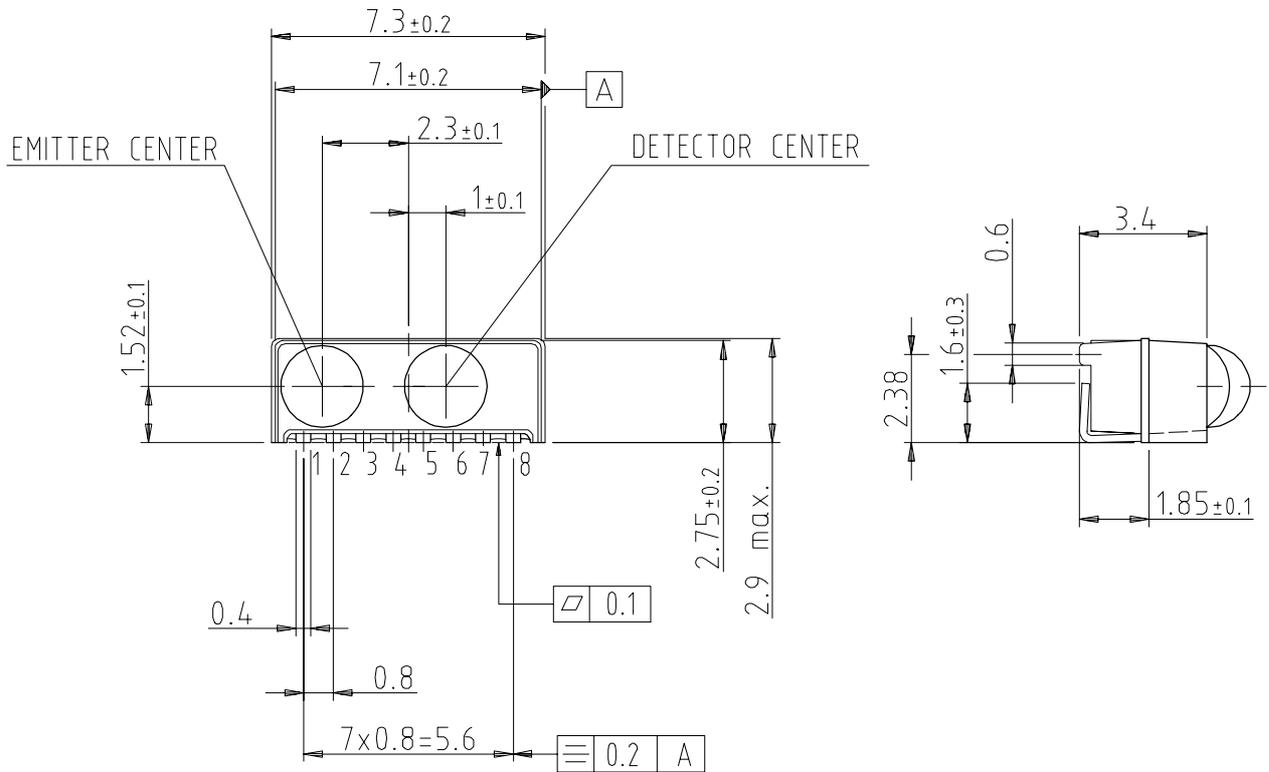


Figure 3. shows the maximum operating temperature when the device is operated without external current limiting resistor. A power dissipating resistor of 2 Ω is recommended from the cathode of the IRED to Ground for supply voltages above 4 V. In that case the device can be operated up to 85°C, too.

Table 1. Truth table

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

TFDU4203--(Mechanical Dimensions)



* MARKING ORIENTATION
180 DEGREES ALLOWED

Drawing-No.: 6.550-5185.01-4
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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 μ 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 dependent on the power supply quality. A good choice is between 4.7 μ F and 10 μ F.

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 μ 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

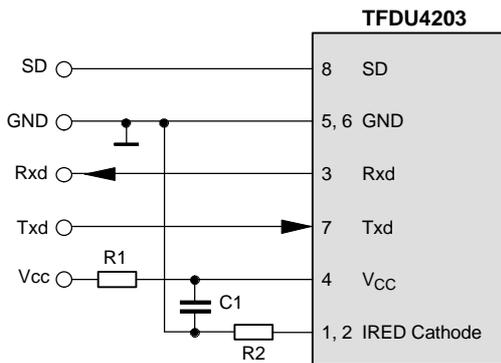


Table 1. Recommended Application Circuit Components *)

| Component | Recommended Value | Vishay Part Number |
|-----------|-------------------|--------------------|
| C1 | 4.7 μ F, 16 V | 293D 475X9 016B 2T |
| R1 | 5 Ω max | |

*) This is a recommendation for a combination to start with to exclude power supply effects. Optimum, from a costs point of view, to work without both.



Revision History:

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

Ozone Depleting Substances Policy Statement

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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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