



# TCND5000

Vishay Semiconductors

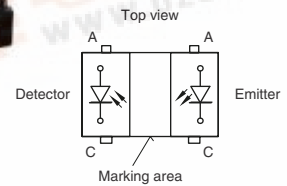
## Reflective Optical Sensor with PIN Photodiode Output

### Description

The TCND5000 is a reflective sensor that includes an infrared emitter and PIN photodiode in a surface mount package which blocks visible light.

### Features

- Package type: Surface mount
- Detector type: PIN Photodiode
- Dimensions:  
L 6 mm x W 4.3 mm x H 3.75 mm
- Peak operating distance: 6 mm
- Peak operating range: 2 mm to 25 mm
- Typical output current under test:  $I_{ra} > 0.11 \mu A$
- Daylight blocking filter
- High linearity
- Emitter wavelength 940 nm
- Lead (Pb)-free soldering released
- Lead (Pb)-free component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC
- Minimum order quantity 2000 pcs, 2000 pcs/reel



### Applications

- Proximity sensor
- Object sensor
- Motion sensor
- Touch key

### Absolute Maximum Ratings

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

#### Input (Emitter)

| Parameter            | Test condition  | Symbol   | Value | Unit             |
|----------------------|---|----------|-------|------------------|
| Reverse Voltage      |   | $V_R$    | 5     | V                |
| Forward current      |   | $I_F$    | 100   | mA               |
| Peak Forward Current | $t_p = 50 \mu s, T = 2 \text{ ms}, T_{amb} = 25 \text{ }^\circ\text{C}$ | $I_{FM}$ | 500   | mA               |
| Power Dissipation    |   | $P_V$    | 190   | mW               |
| Junction Temperature |   | $T_j$    | 100   | $^\circ\text{C}$ |

#### Output (Detector)

| Parameter            | Test condition | Symbol | Value | Unit             |
|----------------------|----------------|--------|-------|------------------|
| Reverse Voltage      |                | $V_R$  | 60    | V                |
| Power Dissipation    |                | $P_V$  | 75    | mW               |
| Junction Temperature |                | $T_j$  | 100   | $^\circ\text{C}$ |



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## Sensor

| Parameter                   | Test condition | Symbol    | Value         | Unit |
|-----------------------------|----------------|-----------|---------------|------|
| Operating Temperature Range |                | $T_{amb}$ | - 40 to + 85  | °C   |
| Storage Temperature Range   |                | $T_{stg}$ | - 40 to + 100 | °C   |
| Soldering Temperature       | acc. fig. 14   | $T_{sd}$  | 260           | °C   |

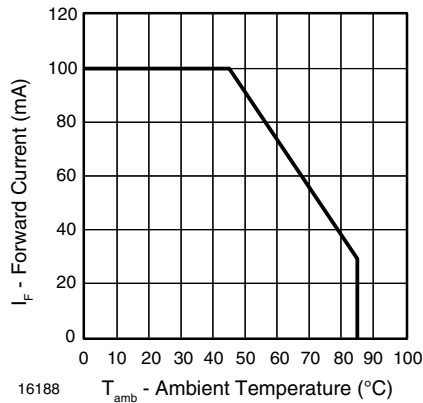


Figure 1. Forward Current Limit vs. Ambient Temperature

## Electrical Characteristics

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

### Input (Emitter)

| Parameter                        | Test condition                                    | Symbol           | Min | Typ.     | Max | Unit          |
|----------------------------------|---|------------------|-----|----------|-----|---------------|
| Forward Voltage                  | $I_F = 20\text{ mA}$ , $t_p = 20\text{ ms}$       | $V_F$            |     | 1.2      | 1.5 | V             |
| Temp. Coefficient of $V_F$       | $I_F = 1\text{ mA}$                               | $TK_{V_F}$       |     | - 1.3    |     | mV/K          |
| Reverse Current                  | $V_R = 5\text{ V}$                                | $I_R$            |     |          | 10  | $\mu\text{A}$ |
| Junction Capacitance             | $V_R = 0\text{ V}$ , $f = 1\text{ MHz}$ , $E = 0$ | $C_j$            |     | 25       |     | pF            |
| Radiant Intensity                | $I_F = 20\text{ mA}$ , $t_p = 20\text{ ms}$       | $I_e$            |     | 7        | 75  | mW/sr         |
| Angle of Half Intensity          |   | $\phi$           |     | $\pm 12$ |     | deg           |
| Peak Wavelength                  | $I_F = 100\text{ mA}$                             | $\lambda_p$      | 930 | 940      |     | nm            |
| Spectral Bandwidth               | $I_F = 100\text{ mA}$                             | $\Delta\lambda$  |     | 50       |     | nm            |
| Temp. Coefficient of $\lambda_p$ | $I_F = 100\text{ mA}$                             | $TK_{\lambda_p}$ |     | 0.2      |     | nm/K          |
| Rise Time                        | $I_F = 100\text{ mA}$                             | $t_r$            |     | 800      |     | ns            |
| Fall Time                        | $I_F = 100\text{ mA}$                             | $t_f$            |     | 800      |     | ns            |
| Virtual Source Diameter          | Method: 63 % encircled energy                     | $\emptyset$      |     | 1.2      |     | mm            |

see figures 2 to 8 accordingly

## Output (Detector)

| Parameter                      | Test condition   | Symbol          | Min | Typ.        | Max | Unit          |
|--------------------------------|--|-----------------|-----|-------------|-----|---------------|
| Forward Voltage                | $I_F = 50 \text{ mA}$  | $V_F$           |     | 1.0         | 1.3 | V             |
| Breakdown Voltage              | $I_R = 100 \text{ }\mu\text{A}$  | $V_{BR}$        | 60  |             |     | V             |
| Reverse Dark Current           | $V_R = 10 \text{ V}, E = 0$  | $I_{ro}$        |     | 1           | 10  | nA            |
| Diode capacitance              | $V_R = 5 \text{ V}, f = 1 \text{ MHz}, E = 0$                              | $C_D$           |     | 1.8         |     | pF            |
| Reverse Light Current          | $E_e = 1 \text{ mW/cm}^2$<br>$\lambda = 950 \text{ nm}, V_R = 5 \text{ V}$ | $I_{ra}$        |     | 12          |     | $\mu\text{A}$ |
| Temp. Coefficient of $I_{ra}$  | $V_R = 5 \text{ V}, \lambda = 870 \text{ nm}$                              | $TK_{Ira}$      |     | 0.2         |     | %/K           |
| Angle of Half Intensity        |  | $\phi$          |     | $\pm 15$    |     | deg           |
| Wavelength of Peak Sensitivity |  | $\lambda_p$     |     | 930         |     | nm            |
| Range of Spectral Bandwidth    |  | $\lambda_{0.5}$ |     | 840 to 1050 |     | nm            |

see figures 9 to 12 accordingly

## Sensor

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

| Parameter             | Test condition  | Symbol   | Min | Typ. | Max | Unit |
|-----------------------|---|----------|-----|------|-----|------|
| Reverse Light Current | $V_R = 2.5 \text{ V}, I_F = 20 \text{ mA}$<br>$D = 30 \text{ mm}$<br>reflective mode:<br>see figure 2 | $I_{ra}$ | 110 |      |     | nA   |

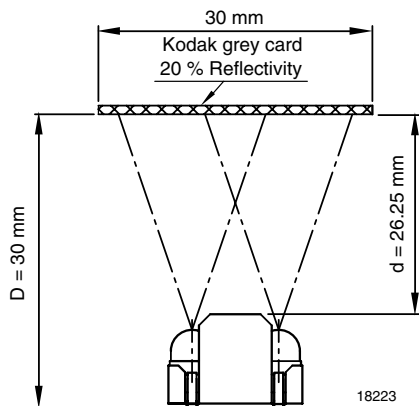


Figure 2. Test Circuit

## Typical Characteristics

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

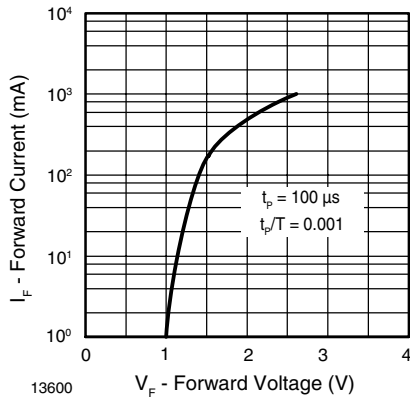


Figure 3. Forward Current vs. Forward Voltage

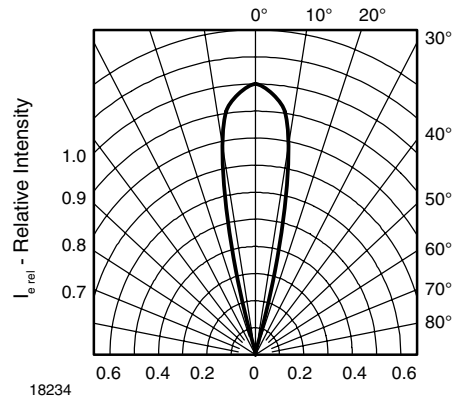


Figure 6. Relative Radiant Intensity vs. Angular Displacement

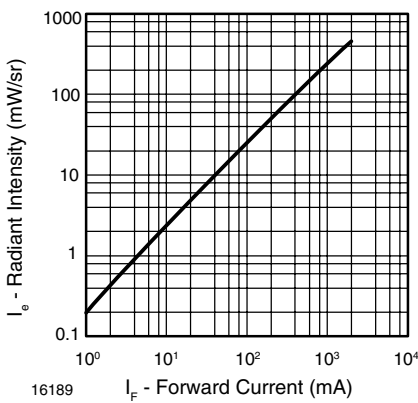


Figure 4. Radiant Intensity vs. Forward Current

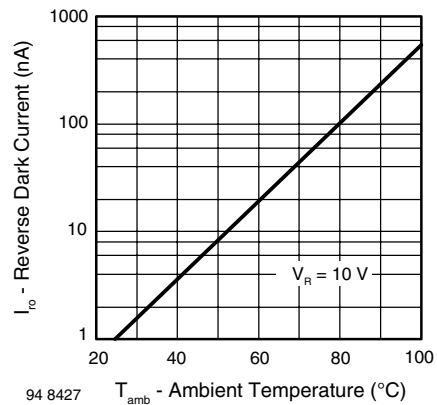


Figure 7. Reverse Dark Current vs. Ambient Temperature

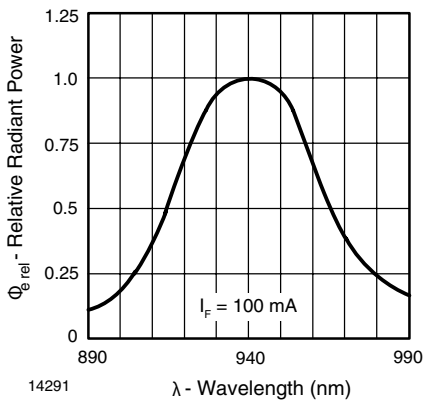


Figure 5. Relative Radiant Power vs. Wavelength

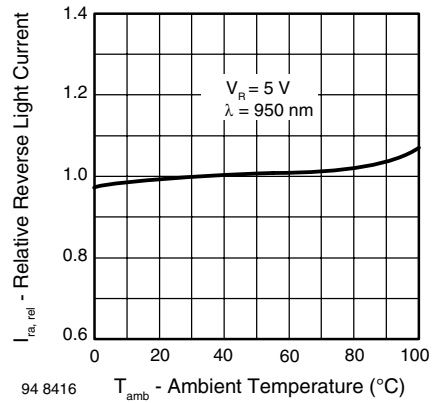


Figure 8. Relative Reverse Light Current vs. Ambient Temperature

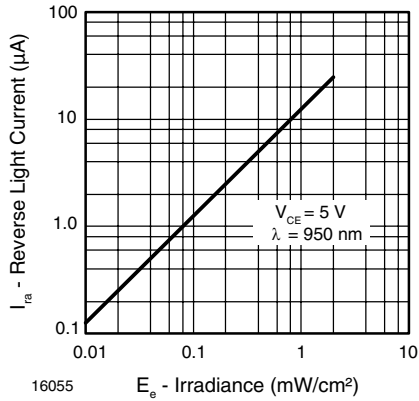


Figure 9. Reverse Light Current vs. Irradiance

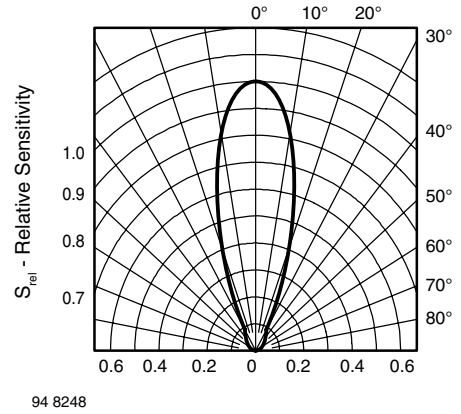


Figure 12. Relative Radiant Sensitivity vs. Angular Displacement

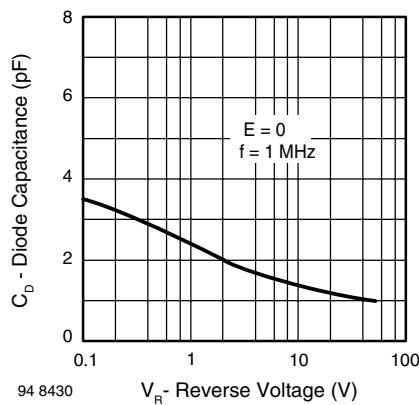


Figure 10. Diode Capacitance vs. Reverse Voltage

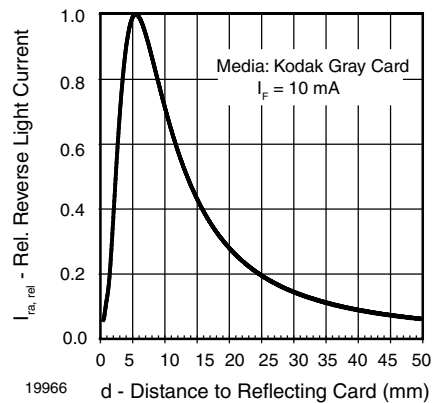


Figure 13. Relative Reverse Light Current vs. Distance

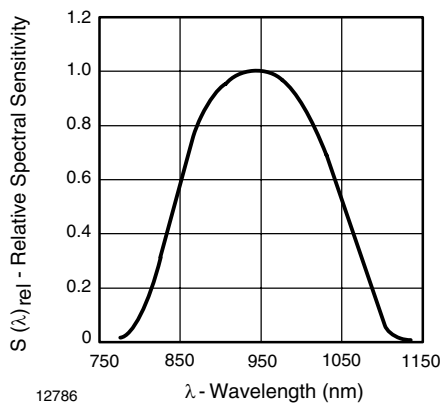


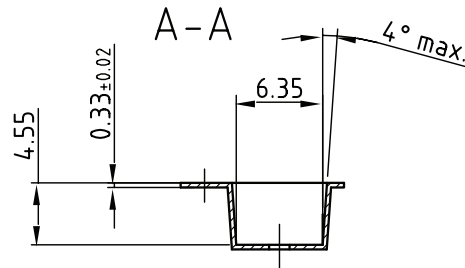
Figure 11. Relative Spectral Sensitivity vs. Wavelength

# TCND5000

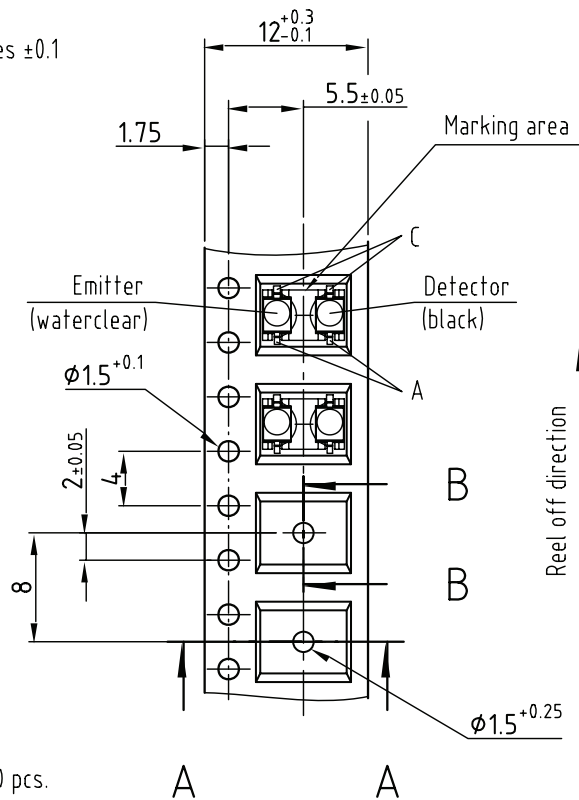
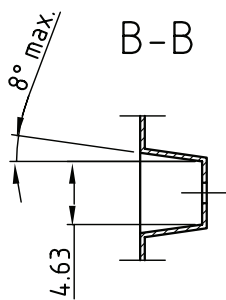
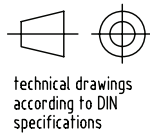
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## Taping



Dimensions in mm  
Not indicated tolerances  $\pm 0.1$

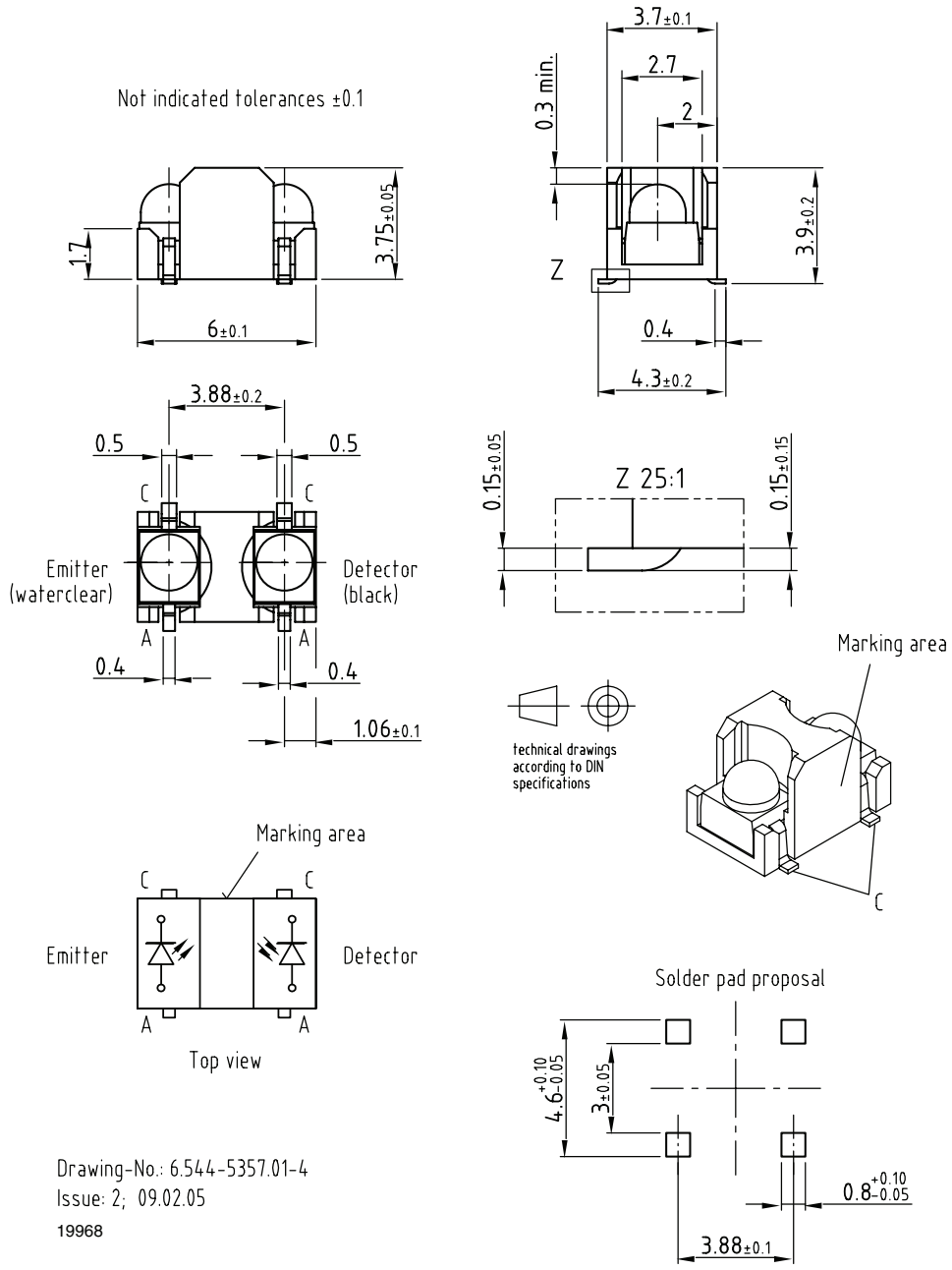


Quantity per reel: 2000 pcs.

Material of Blister tape: PC black  
Sealing of cavities with hot sealing cover tape,  
C-Pak Type CP - 2010 AS ( Thickness: 0.055 - 0.075mm; Base Material: Polyester )

Drawing-No.: 9.700-5281.01-4  
Issue: 4; 10.02.05  
18222

## Package Dimensions in mm



Drawing-No: 6.544-5357.01-4  
 Issue: 2; 09.02.05  
 19968

## Precautions For Use

### 1. Over-current-proof

Customer must apply resistors for protection, otherwise slight voltage shift will cause big current change (Burn out will happen).

### 2. Storage

2.1 Storage temperature and rel. humidity conditions are: 5 °C to 30 °C, R.H. 60 %

2.2 Floor life must not exceed 72 h, acc. to JEDEC level 4, J-STD-020.

Once the package is opened, the products should be used within 72 h. Otherwise, they should be kept in a damp proof box with desiccant.

Considering tape life, we suggest to use products within one year from production date.

2.3 If opened more than 72 h in an atmosphere 5 °C to 30 °C, R.H. 60 %, devices should be treated at 60 °C ± 5 °C for 15 hrs.

2.4 If humidity indicator in the package shows pink color (normal blue), then devices should be treated with the same conditions as 2.3

## Reflow Solder Profiles

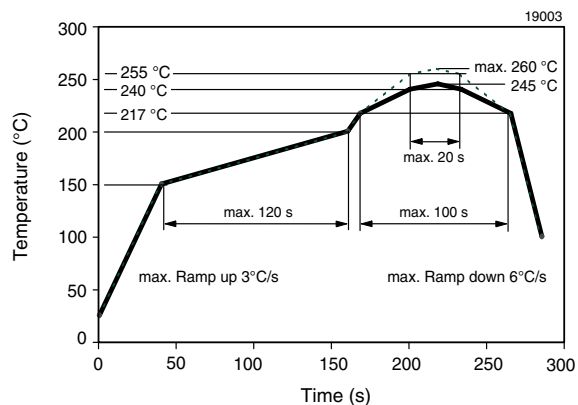


Figure 14. Lead (Pb)-Free Reflow Solder Profile

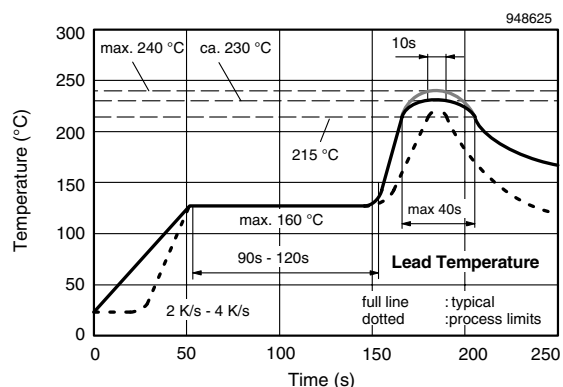


Figure 15. Lead Tin (SnPb) Reflow Solder Profile



**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.

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