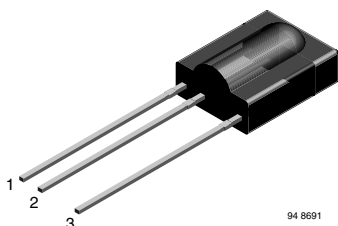


## IR Receiver Modules for Remote Control Systems



94 8691

### MECHANICAL DATA

#### Pinning:

1 = GND, 2 =  $V_S$ , 3 = OUT

### FEATURES

- Very low supply current
- Photo detector and preamplifier in one package
- Internal filter for PCM frequency
- Improved shielding against EMI
- Supply voltage: 2.5 V to 5.5 V
- Improved immunity against ambient light
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC
- Insensitive to supply voltage ripple and noise



### DESCRIPTION

The TSOP311.., TSOP313.. series are miniaturized receivers for infrared remote control systems. A PIN diode and a preamplifier are assembled on a lead frame, the epoxy package acts as an IR filter.

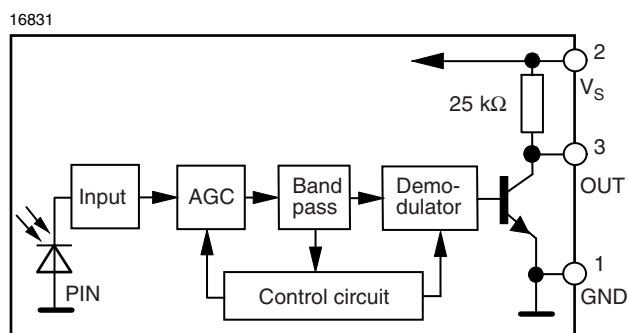
The demodulated output signal can be directly decoded by a microprocessor. The TSOP311.. is compatible with all common IR remote control data formats. The TSOP313.. is optimized to better suppress spurious pulses from energy saving fluorescent lamps but will also suppress some data signals.

This component has not been qualified according to automotive specifications.

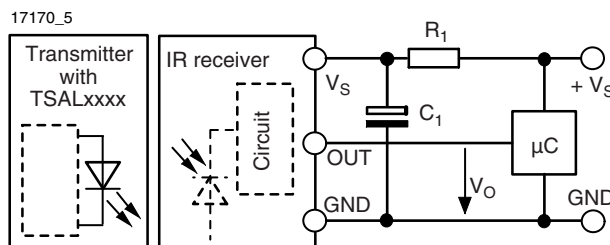
### PARTS TABLE

CARRIER FREQUENCY	SHORT BURSTS AND HIGH DATA RATES (AGC1)	NOISY ENVIRONMENTS AND SHORT BURSTS (AGC3)
30 kHz	TSOP31130	TSOP31330
33 kHz	TSOP31133	TSOP31333
36 kHz	TSOP31136	TSOP31336
38 kHz	TSOP31138	TSOP31338
40 kHz	TSOP31140	TSOP31340
56 kHz	TSOP31156	TSOP31356

### BLOCK DIAGRAM



### APPLICATION CIRCUIT



$R_1$  and  $C_1$  are recommended for protection against EOS. Components should be in the range of  $33 \Omega < R_1 < 1 \text{ k}\Omega$ ,  $C_1 > 0.1 \mu\text{F}$ .



ABSOLUTE MAXIMUM RATINGS (1)				
PARAMETER	TEST CONDITION	SYMBOL	VALUE	UNIT
Supply voltage (pin 2)		$V_S$	- 0.3 to + 6.0	V
Supply current (pin 2)		$I_S$	3	mA
Output voltage (pin 3)		$V_O$	- 0.3 to ( $V_S + 0.3$ )	V
Output current (pin 3)		$I_O$	5	mA
Junction temperature		$T_j$	100	°C
Storage temperature range		$T_{stg}$	- 25 to + 85	°C
Operating temperature range		$T_{amb}$	- 25 to + 85	°C
Power consumption	$T_{amb} \leq 85 \text{ °C}$	$P_{tot}$	10	mW
Soldering temperature	$t \leq 10 \text{ s}$ , 1 mm from case	$T_{sd}$	260	°C

**Note**

(1) Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect the device reliability.

ELECTRICAL AND OPTICAL CHARACTERISTICS (1)						
PARAMETER	TEST CONDITION	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply current (pin 2)	$E_v = 0$ , $V_S = 3.3 \text{ V}$	$I_{SD}$	0.27	0.35	0.45	mA
	$E_v = 40 \text{ klx}$ , sunlight	$I_{SH}$		0.45		mA
Supply voltage		$V_S$	2.5		5.5	V
Transmission distance	$E_v = 0$ , test signal see fig. 1, IR diode TSAL6200, $I_F = 250 \text{ mA}$	$d$		45		m
Output voltage low (pin 3)	$I_{OSL} = 0.5 \text{ mA}$ , $E_e = 0.7 \text{ mW/m}^2$ , test signal see fig. 1	$V_{OSL}$			100	mV
Minimum irradiance	Pulse width tolerance: $t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$ , test signal see fig. 1	$E_e \text{ min.}$		0.15	0.35	$\text{mW/m}^2$
Maximum irradiance	$t_{pi} - 5/f_0 < t_{po} < t_{pi} + 6/f_0$ , test signal see fig. 1	$E_e \text{ max.}$	30			$\text{W/m}^2$
Directivity	Angle of half transmission distance	$\phi_{1/2}$		$\pm 45$		deg

**Note**

(1)  $T_{amb} = 25 \text{ °C}$ , unless otherwise specified

**TYPICAL CHARACTERISTICS**

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

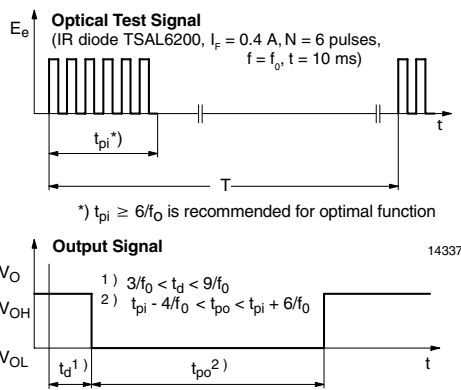


Fig. 1 - Output Active Low

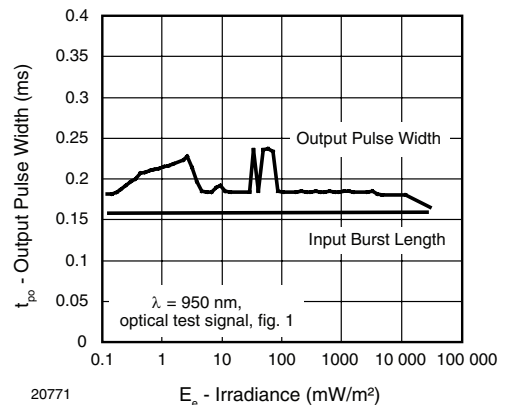


Fig. 2 - Pulse Length and Sensitivity in Dark Ambient

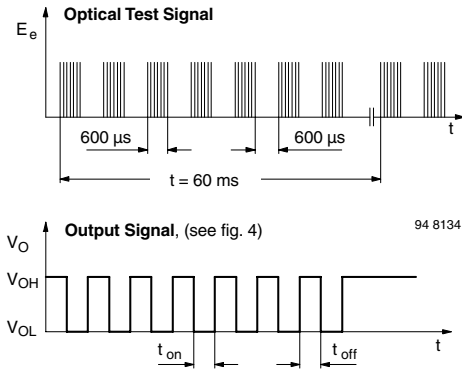
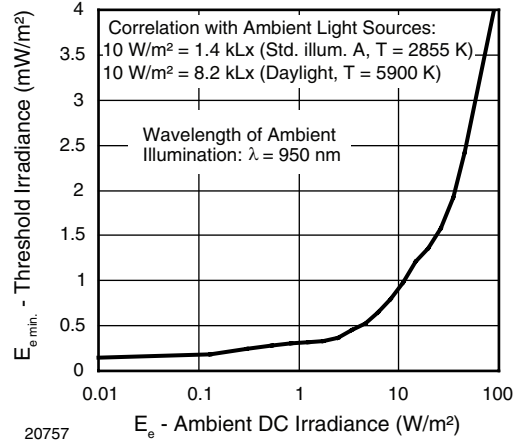
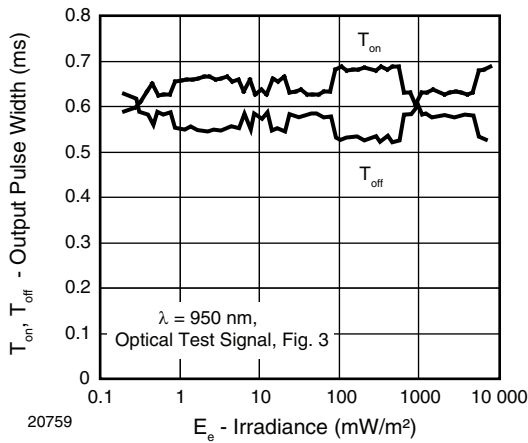


Fig. 3 - Output Function



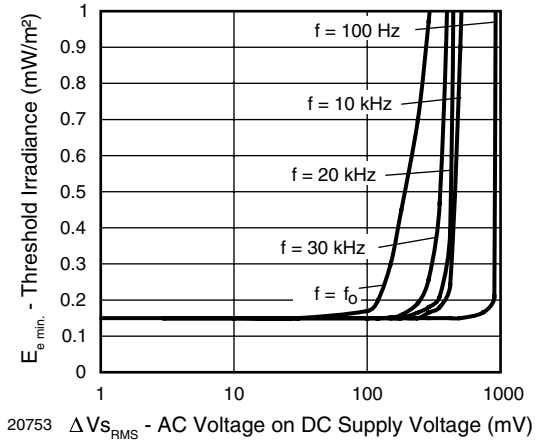
20757

Fig. 6 - Sensitivity in Bright Ambient



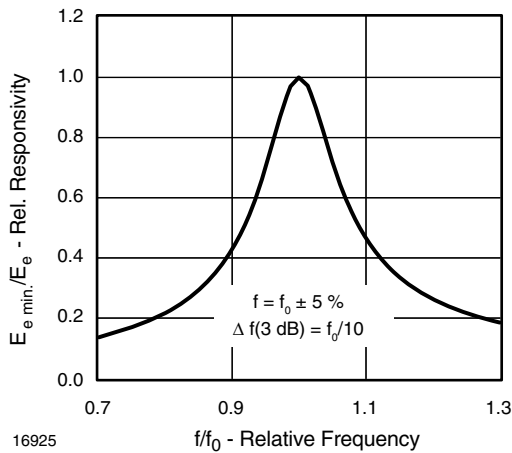
20759

Fig. 4 - Output Pulse Diagram



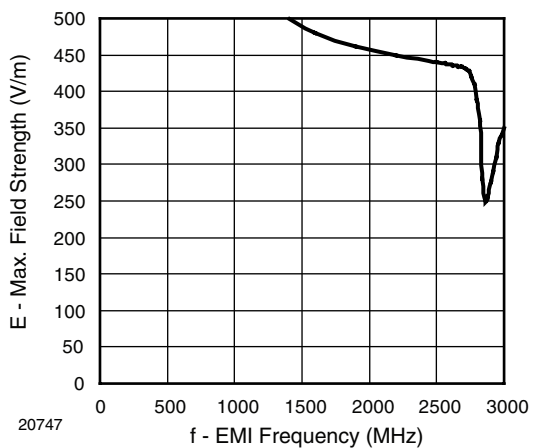
20753

Fig. 7 - Sensitivity vs. Supply Voltage Disturbances



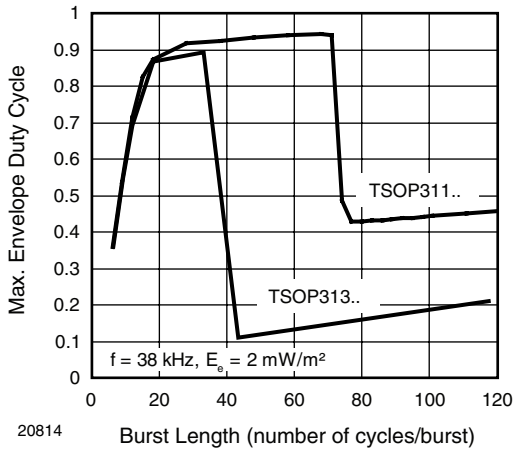
16925

Fig. 5 - Frequency Dependence of Responsivity

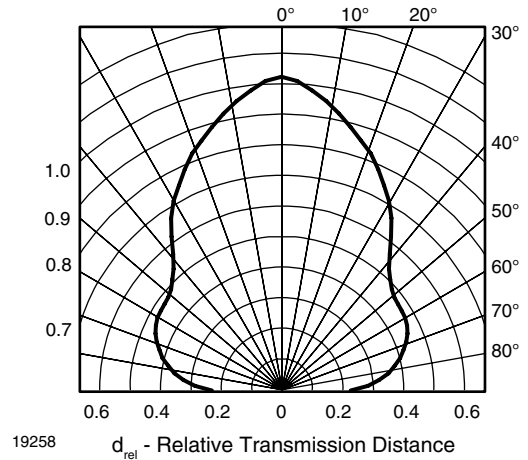


20747

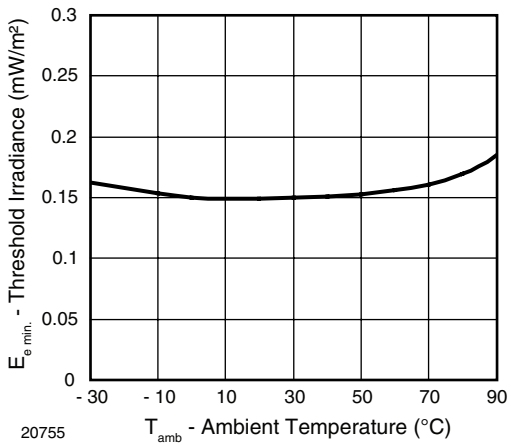
Fig. 8 - Sensitivity vs. Electric Field Disturbances



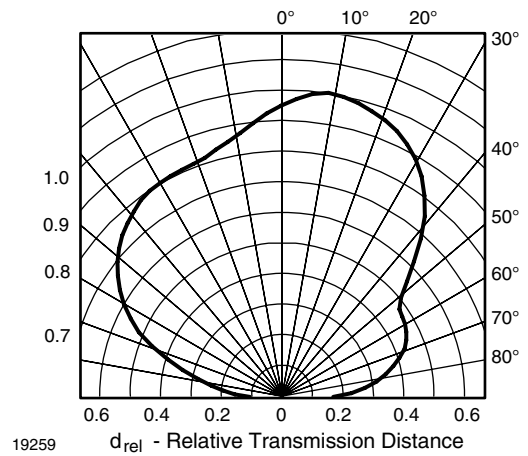
20814  
Burst Length (number of cycles/burst)  
Fig. 9 - Max. Envelope Duty Cycle vs. Burst Length



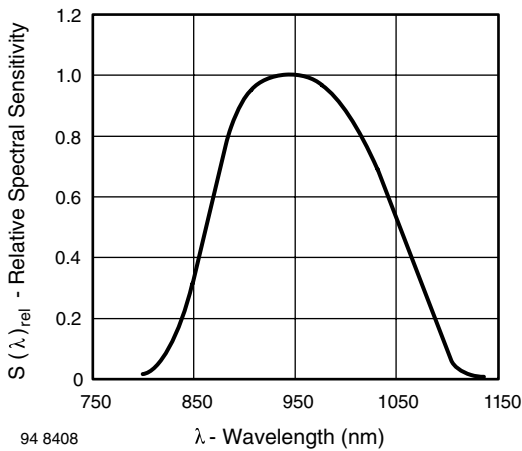
19258  
d<sub>rel</sub> - Relative Transmission Distance  
Fig. 12 - Horizontal Directivity



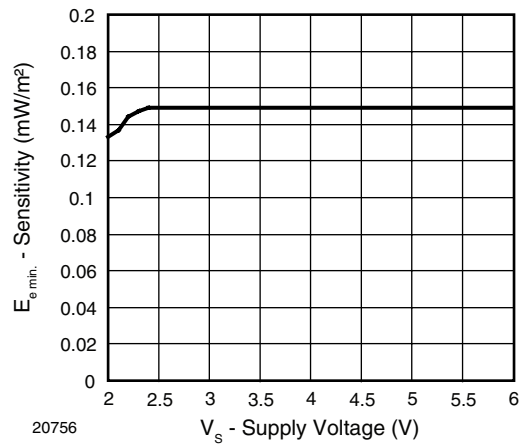
20755  
T<sub>amb</sub> - Ambient Temperature (°C)  
Fig. 10 - Sensitivity vs. Ambient Temperature



19259  
d<sub>rel</sub> - Relative Transmission Distance  
Fig. 13 - Vertical Directivity



94 8408  
λ - Wavelength (nm)  
Fig. 11 - Relative Spectral Sensitivity vs. Wavelength



20756  
V<sub>s</sub> - Supply Voltage (V)  
Fig. 14 - Sensitivity vs. Supply Voltage

## SUITABLE DATA FORMAT

The TSOP311.., TSOP313.. series are designed to suppress spurious output pulses due to noise or disturbance signals. Data and disturbance signals can be distinguished by the devices according to carrier frequency, burst length and envelope duty cycle. The data signal should be close to the band-pass center frequency (e.g. 38 kHz) and fulfill the conditions in the table below.

When a data signal is applied to the TSOP311.., TSOP313.. in the presence of a disturbance signal, the sensitivity of the receiver is reduced to insure that no spurious pulses are present at the output. Some examples of disturbance signals which are suppressed are:

- DC light (e.g. from tungsten bulb or sunlight)
- Continuous signals at any frequency
- Modulated noise from fluorescent lamps with electronic ballasts

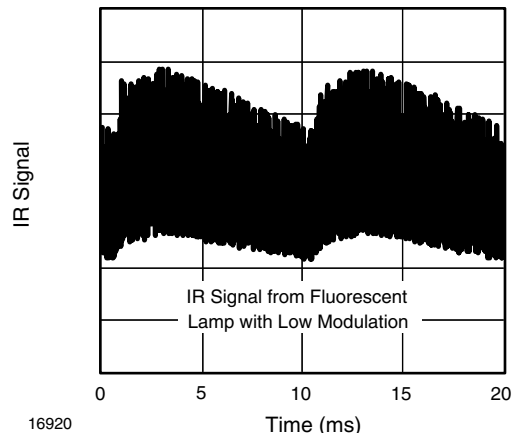


Fig. 15 - IR Signal from Fluorescent Lamp with Low Modulation

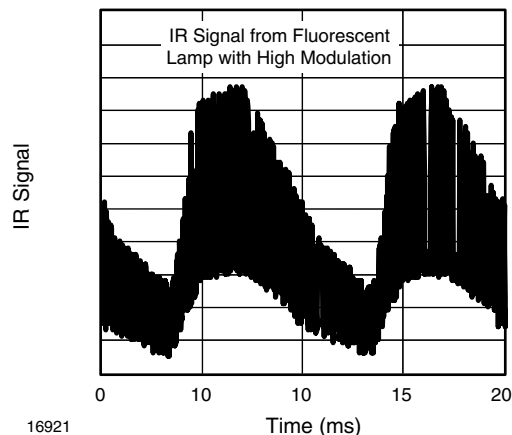


Fig. 16 - IR Signal from Fluorescent Lamp with High Modulation

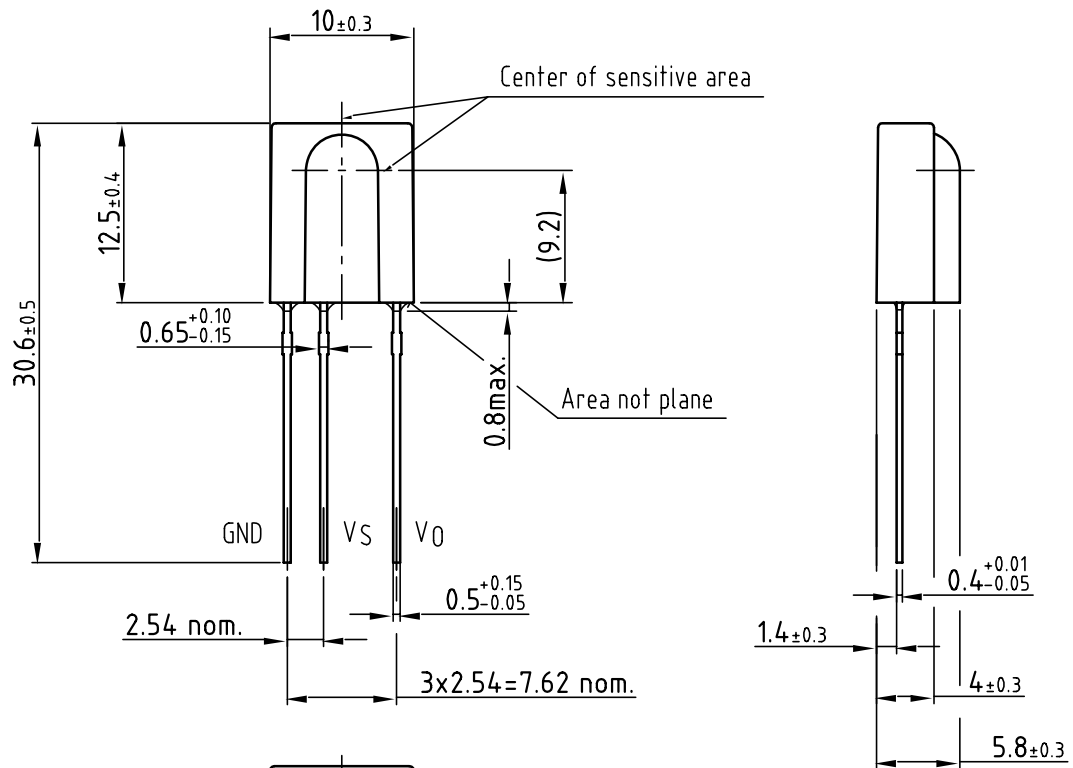
	TSOP311..	TSOP313..
Minimum burst length	6 cycles/burst	6 cycles/burst
After each burst of length A gap time is required of	6 to 70 cycles ≥ 10 cycles	6 to 35 cycles ≥ 10 cycles
For bursts greater than A minimum gap time in the data stream is needed of	70 cycles > 1.2 x burst length	35 cycles > 6 x burst length
Maximum number of continuous short bursts/second	2000	2000
Compatible to NEC code	yes	yes
Compatible to RC5/RC6 code	yes	yes
Compatible to Sony code	yes	no
Compatible to RCMM code	yes	yes
Compatible to r-step code	yes	yes
Compatible to XMP code	yes	yes
Suppression of interference from fluorescent lamps	Common disturbance signals are suppressed (Example: Signal pattern of fig. 15)	Even critical disturbance signals are suppressed (Examples: Signal pattern of fig. 15 and fig. 16)

### Note

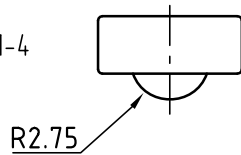
For data formats with short bursts please see the data sheet for TSOP381.., TSOP383..



**PACKAGE DIMENSIONS** in millimeters



Drawing-No.: 6.550-5095.01-4  
Issue: 17; 22.03.04



technical drawings  
according to DIN  
specifications

96 12116

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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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