

## Serial Infrared Transceiver SIR, 115.2 kbit/s, 2.7 V to 5.5 V Operation

### Description

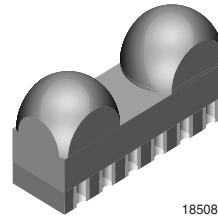
The TFBS4711 is a low profile, Infrared Data Transceiver module. It supports IrDA data rates up to 115.2 kbit/s (SIR). The transceiver module consists of a PIN photodiode, an infrared emitter (IRED), and a low-power CMOS control IC to provide a total front-end solution in a single package.

The device is designed for the low power IrDA standard with an extended range on-axis up to 1 m. The Rxd pulse width is independent of the duration of Txd pulse and always stays at a fixed width thus making

the device optimum for all standard SIR Encoder/Decoder and interfaces. The Shut Down (SD) feature cuts current consumption to typically 10 nA.

### Features

- Compliant with the latest IrDA physical layer low power specification ( 9.6 kbit/s to 115.2 kbit/s)
- Small package:  
H 1.9 mm x D 3.1 mm x L 6.0 mm
- Industries smallest footprint  
- 6.0 mm length  
- 1.9 mm height
- Typical Link distance on-axis up to 1 m
- Battery & Power Management Features:  
> Idle Current - 75  $\mu$ A Typical  
> Shutdown Current - 10 nA Typical  
> Operates from 2.4 V - 5.5 V within specification over full temperature range from - 25 °C to + 85 °C
- Remote Control - transmit distance up to 8 meters
- Tri-State Receiver Output, floating in shutdown with a weak pull-up
- Constant Rxd output pulse width (2  $\mu$ s typical)
- Meets IrFM Fast Connection requirements



- Split power supply, an independent, unregulated supply for IRED Anode and a well regulated supply for V<sub>CC</sub>
- Directly Interfaces with Various Super I/O and Controller Devices and Encoder/ Decoder such as TOIM4232.

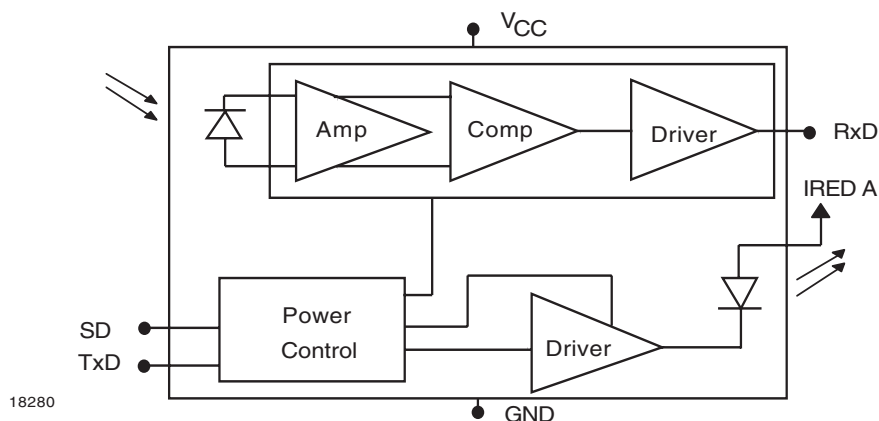
### Applications

- Ideal for Battery Operated Devices
- PDAs
- Mobile Phones
- Electronic Wallet (IrFM)
- Notebook Computers
- Digital Still and Video Cameras
- Printers, Fax Machines, Photocopiers, Screen Projectors
- Data Loggers
- External Infrared Adapters (Dongles)
- Diagnostics Systems
- Medical and Industrial Data Collection Devices
- Kiosks, POS, Point and Pay Devices
- GPS
- Access Control
- Field Programming Devices

### Parts Table

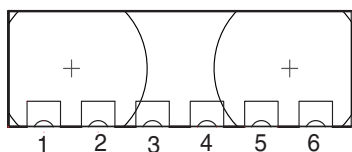
Part	Description	Qty / Reel
TFBS4711-TR1	Oriented in carrier tape for side view surface mounting	1000 pcs
TFBS4711-TR3	Oriented in carrier tape for side view surface mounting	2500 pcs

## Functional Block Diagram



### Pinout

TFBS4711  
weight 50 mg



18466

### Definitions:

In the Vishay transceiver data sheets the following nomenclature is used for defining the IrDA operating modes:

SIR: 2.4 kbit/s to 115.2 kbit/s, equivalent to the basic serial infrared standard with the physical layer version IrPhy 1.0

MIR: 576 kbit/s to 1152 kbit/s

FIR: 4 Mbit/s

VFIR: 16 Mbit/s

MIR and FIR were implemented with IrPhy 1.1, followed by IrPhy 1.2, adding the SIR Low Power Standard. IrPhy 1.3 extended the Low Power Option to MIR and FIR and VFIR was added with IrPhy 1.4. A new version of the standard in any case obsoletes the former version.

With introducing the updated versions the old versions are obsolete. Therefore the only valid IrDA standard is the actual version IrPhy 1.4 (in Oct. 2002).

### Pin Description

Pin Number	Function	Description	I/O	Active
1	IRED Anode	IRED Anode is directly connected to a power supply. The LED current can be decreased by adding a resistor in series between the power supply and IRED Anode. A separate unregulated power supply can be used at this pin.		
2	TxD	This Input is used to turn on IRED transmitter when SD is low. An on-chip protection circuit disables the LED driver if the TxD pin is asserted for longer than 80 $\mu$ s	I	HIGH
3	RxD	Received Data Output, normally stays high but goes low for a fixed duration during received pulses. It is capable of driving a standard CMOS or TTL load.	O	LOW
4	SD	Shutdown. Setting this pin active switches the device into shutdown mode	I	HIGH
5	V <sub>CC</sub>	Supply Voltage		
6	GND	Ground		



## Absolute Maximum Ratings

Reference Point Ground, Pin 6 unless otherwise noted.

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Supply voltage range, all states		$V_{CC}$	- 0.5		+ 6.0	V
Input current	For all Pins except IRED Anode Pin	$I_{CC}$			10.0	mA
Output sink current, Rxd					25.0	mA
Average output current, pin 1	20 % duty cycle	$I_{IRED (DC)}$			80	mA
Repetitive pulsed output current	$< 90 \mu s, t_{on} < 20 \%$	$I_{IRED (RP)}$			400	mA
IRED anode voltage, pin 1		$V_{IRED A}$	- 0.5		+ 6.0	V
Voltage at all inputs and outputs	$V_{in} > V_{CC}$ is allowed	$V_{IN}$	- 0.5		+ 6.0	V
Ambient temperature range (operating)		$T_{amb}$	- 30		+ 85	°C
Storage temperature range		$T_{stg}$	- 40		+ 100	°C
Soldering temperature	See Recommended Solder Profile				240	°C

## Eye safety information

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Virtual source size	Method: (1-1/e) encircled energy	d	1.3	1.5		mm
Maximum intensity for class 1	IEC60825-1 or EN60825-1, edition Jan. 2001, operating below the absolute maximum ratings	$I_e$			*) (500)**)	mW/sr

## Electrical Characteristics

### Transceiver

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = V_{IREDA} = 2.4\text{ V to }5.5\text{ V}$  unless otherwise noted.

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Supply voltage range, all states		$V_{CC}$	2.4		5.5	V
Idle supply current @ $V_{CC1}$ (receive mode, no signal)	SD = Low, $E_e = 1\text{ klx}^*)$ , $T_{amb} = -25\text{ }^{\circ}\text{C to }+85\text{ }^{\circ}\text{C}$ , $V_{CC} = 2.7\text{ V to }5.5\text{ V}$	$I_{CC1}$			130	$\mu\text{A}$
	SD = Low, $E_e = 1\text{ klx}^*)$ , $T_{amb} = 25\text{ }^{\circ}\text{C}$ , $V_{CC} = 2.7\text{ V to }5.5\text{ V}$	$I_{CC1}$		75		$\mu\text{A}$
Receive current	$V_{CC} = 2.7\text{ V}$	$I_{CC}$		80		$\mu\text{A}$
Shutdown current	SD = High, $T = 25\text{ }^{\circ}\text{C}$ , $E_e = 0\text{ klx}$	$I_{SD}$		< 0.1	2	$\mu\text{A}$
	SD = High, $T = 85\text{ }^{\circ}\text{C}$	$I_{SD}$			3	$\mu\text{A}$
Operating temperature range		$T_A$	- 25		+ 85	$^{\circ}\text{C}$
Output voltage low, Rxd	$I_{OL} = 1\text{ mA}$	$V_{OL}$	- 0.5		$0.15 \times V_{CC}$	V
Output voltage high, Rxd	$I_{OH} = -500\text{ }\mu\text{A}$	$V_{OH}$	$0.8 \times V_{CC}$		$V_{CC} + 0.5$	V
	$I_{OH} = -250\text{ }\mu\text{A}$	$V_{OH}$	$0.9 \times V_{CC}$		$V_{CC} + 0.5$	V
Rxd to $V_{CC}$ impedance		$R_{Rxd}$	400	500	600	$\text{k}\Omega$
Input voltage low: Txd, SD		$V_{IL}$	- 0.5		0.5	V
Input voltage high: Txd, SD	CMOS level ( $0.5 \times V_{CC}$ typ, threshold level)	$V_{IH}$	$V_{CC} - 0.5$		6.0	V
Input leakage current (Txd, SD)	$V_{in} = 0.9 \times V_{CC}$	$I_{ICH}$	- 2		+ 2	$\mu\text{A}$
Controlled pull down current	SD, Txd = "0" or "1", $0 < V_{in} < 0.15 V_{CC}$	$I_{IRTx}$			+ 150	$\mu\text{A}$
	SD, Txd = "0" or "1" $V_{in} > 0.7 V_{CC}$	$I_{IRTx}$	- 1	0	1	$\mu\text{A}$
Input capacitance		$C_{IN}$			5	pF

## Optoelectronic Characteristics

### Receiver

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = 2.4\text{ V}$  to  $5.5\text{ V}$  unless otherwise noted

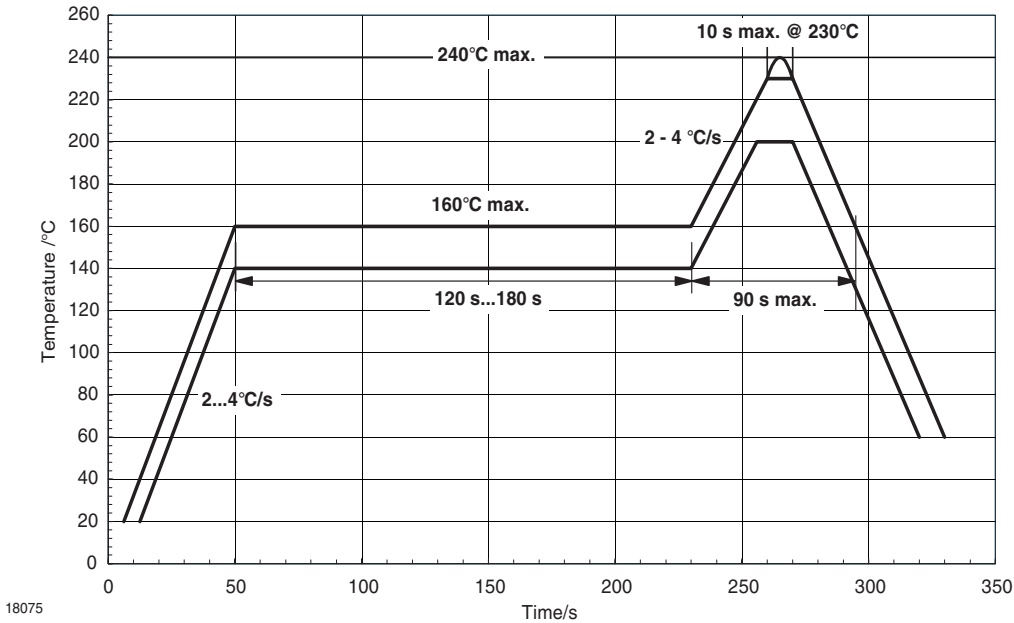
Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Minimum detection threshold irradiance	9.6 kbit/s to 115.2 kbit/s $\lambda = 850\text{ nm} - 900\text{ nm}$ , $\alpha = 0^{\circ}, 15^{\circ}$	$E_e$		35 (3.5)	80 (8)	$\text{mW}/\text{m}^2$ ( $\mu\text{W}/\text{cm}^2$ )
Maximum detection threshold irradiance	$\lambda = 850\text{ nm} - 900\text{ nm}$	$E_e$		5 (500)		$\text{kW}/\text{m}^2$ ( $\text{mW}/\text{cm}^2$ )
Maximum no detection threshold irradiance		$E_e$	4 (0.4)			$\text{mW}/\text{m}^2$ ( $\mu\text{W}/\text{cm}^2$ )
Rise time of output signal	10 % to 90 %, $C_L = 15\text{ pF}$	$t_{r(\text{Rxd})}$	10		100	ns
Fall time of output signal	90 % to 10 %, $C_L = 15\text{ pF}$	$t_{f(\text{Rxd})}$	10		100	ns
Rxd pulse width	Input pulse width $> 1.2\text{ }\mu\text{s}$	$t_{\text{PW}}$	1.7	2.0	3.0	$\mu\text{s}$
Leading edge jitter	Input Irradiance = $100\text{ mW}/\text{m}^2$ , $\leq 115.2\text{ kbit/s}$				250	ns
Standby /Shutdown delay, receiver startup time	After shutdown active or power-on				150	$\mu\text{s}$
Latency		$t_L$			150	$\mu\text{s}$

### Transmitter

$T_{amb} = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = 2.4\text{ V}$  to  $5.5\text{ V}$  unless otherwise noted.

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
IRED operating current	$T_{amb} = -25\text{ }^{\circ}\text{C}$ to $+85\text{ }^{\circ}\text{C}$	$I_D$	200	300	400	mA
Transceiver operating peak supply current	During pulsed IRED operation @ $I_D = 300\text{ mA}$	$I_{CC}$		0.57		mA
IRED leakage current	$T_{xd} = 0\text{ V}$ , $0 < V_{CC} < 5.5\text{ V}$	$I_{\text{IRED}}$	- 1		1	$\mu\text{A}$
Output radiant intensity	$\alpha = 0^{\circ}$ , $T_{xd} = \text{High}$ , $SD = \text{Low}$ , $R = 0\text{ }\Omega$ , $V_{\text{LED}} = 2.4\text{ V}$	$I_e$	tbd	60		$\text{mW}/\text{sr}$
	$\alpha = 0^{\circ}, 15^{\circ}$ , $T_{xd} = \text{High}$ , $SD = \text{Low}$ , $R = 0\text{ }\Omega$ , $V_{\text{LED}} = 2.4\text{ V}$	$I_e$	tbd	35		$\text{mW}/\text{sr}$
	$V_{CC} = 5.0\text{ V}$ , $\alpha = 0^{\circ}, 15^{\circ}$ , $T_{xd} = \text{High}$ or $SD = \text{High}$ (Receiver is inactive as long as $SD = \text{High}$ )	$I_e$			0.04	$\text{mW}/\text{sr}$
Output radiant intensity, angle of half intensity		$\alpha$		$\pm 22$		$^{\circ}$
Peak-emission wavelength		$\lambda_p$	880		900	nm
Spectral bandwidth		$\Delta\lambda$		45		nm
Optical rise time		$t_{\text{ropt}}$	10		100	ns
Optical fall time		$t_{\text{fopt}}$	10		100	ns
Optical output pulse duration	Input pulse width $1.63\text{ }\mu\text{s}$ , $115.2\text{ kbit/s}$	$t_{\text{opt}}$	1.41	1.63	2.23	$\mu\text{s}$
	Input pulse width $t_{\text{Txd}} < 20\text{ }\mu\text{s}$	$t_{\text{opt}}$	$t_{\text{Txd}}$		$t_{\text{Txd}} + 0.15$	$\mu\text{s}$
	Input pulse width $t_{\text{Txd}} \geq 20\text{ }\mu\text{s}$	$t_{\text{opt}}$			300	$\mu\text{s}$
Optical overshoot					25	%

## Recommended Solder Profile



## Recommended Circuit Diagram

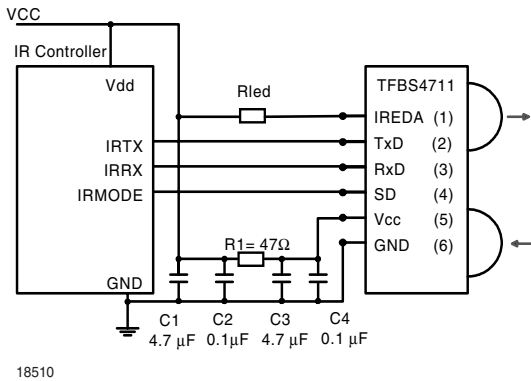


Figure 1. Recommended Application Circuit

The TFBS4711 integrates a sensitive receiver and a built-in power driver. This combination needs a careful circuit layout. The use of thin, long, resistive and inductive wiring should be avoided. The inputs (TxD, SD) and the output (RxD) should be directly (DC) coupled to the I/O circuit.

The combination of resistor R1 and capacitors C1, C2, C3 and C4 filter out any power supply noise to provide a smooth supply voltage.

The placement of these components is critical. It is strongly recommended to position C3 and C4 as close as possible to the transceiver power supply pins. A Tantalum capacitor should be used for C1 and C3 while a ceramic capacitor should be used for C2 and C4.

A current limiting resistor is not needed for normal operation. It is strongly recommended to use the Rled values mentioned in Table 1 below for high temperature operation. For Low Power Mode, IRED Anode voltage of less than 5 V is recommended.

Under extreme EMI conditions as placing a RF - transmitter antenna on top of the transceiver, it is recommended to protect all inputs by a low-pass filter, as a minimum a 12 pF capacitor, especially at the RxD port.

Basic RF design rules for circuit design should be followed. Especially longer signal lines should not be used without proper termination. For reference see "The Art of Electronics" by Paul Horowitz, Winfield Hill, 1989, Cambridge University Press, ISBN: 0521370957.



### I/O and Software

In the description, already different I/Os are mentioned. Different combinations are tested and the function verified with the special drivers available

from the I/O suppliers. In special cases refer to the I/O manual, the Vishay application notes, or contact directly Vishay Sales, Marketing or Application.

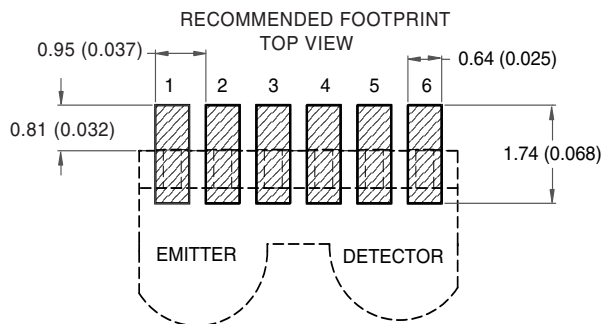
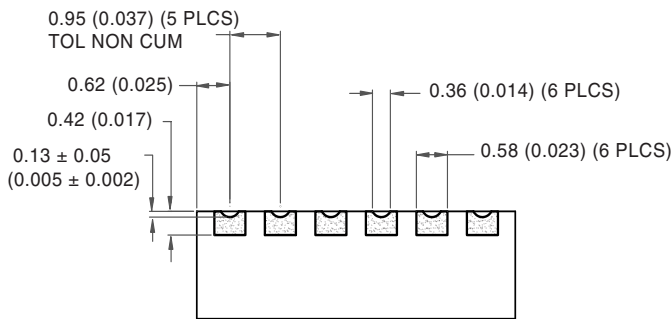
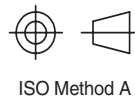
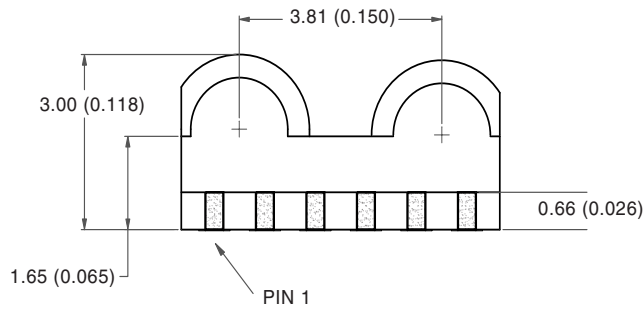
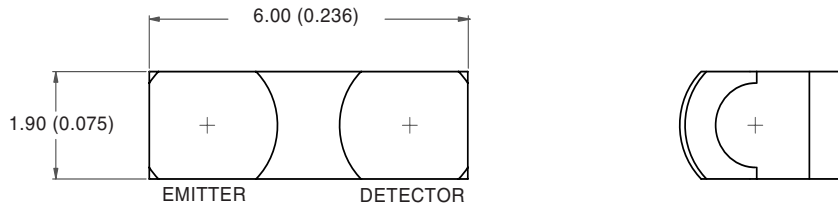
**Table 1.**  
**Recommended Application Circuit Components**

Component	Recommended Value	Vishay Part Number
C1, C3	4.7 $\mu$ F, 16 V	293D 475X9 016B
C2, C4	0.1 $\mu$ F, Ceramic	VJ 1206 Y 104 J XXMT
R1	47 $\Omega$ , 0.125 W	CRCW-1206-47R0-F-RT1
Rled	See Table 1	

**Table 2.**  
**Truth table**

SD	Txd	Optical input Irradiance $\text{mW/m}^2$	Rxd	Transmitter	Operation
Inputs	Inputs	Inputs	Outputs	Outputs	Remark
high	x	x	weakly pulled (500 $\Omega$ ) to $V_{CC1}$	0	Shutdown
low	high	x	high inactive	$I_e$	Transmitting
low	high > 300 $\mu$ s	x	high inactive	0	Protection is active
low	low	< 4	high inactive	0	Ignoring low signals below the IrDA defined threshold for noise immunity
low	low	> Min. Detection Threshold Irradiance < Max. Detection Threshold Irradiance	low (active)	0	Response to an IrDA compliant optical input signal
low	low	> Max. Detection Threshold Irradiance	undefined	0	Overload conditions can cause unexpected outputs

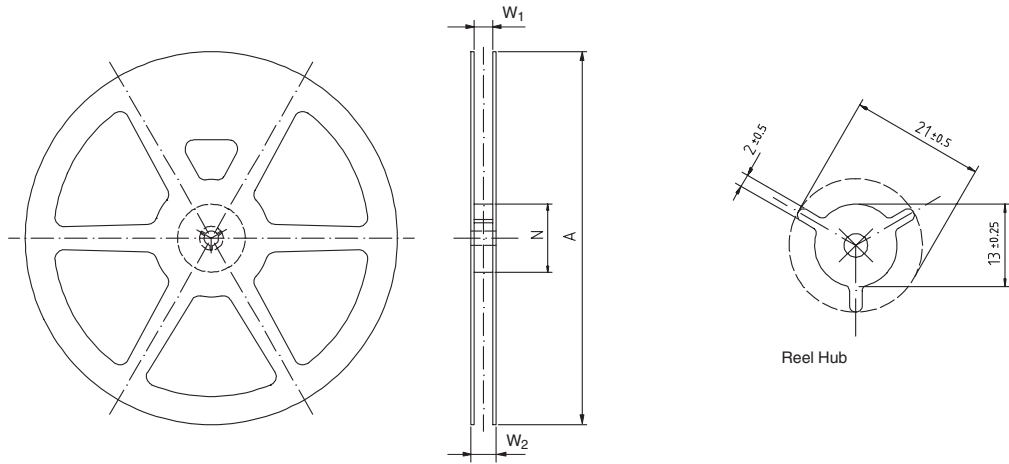
## Package Dimensions in mm (Inches)



18815



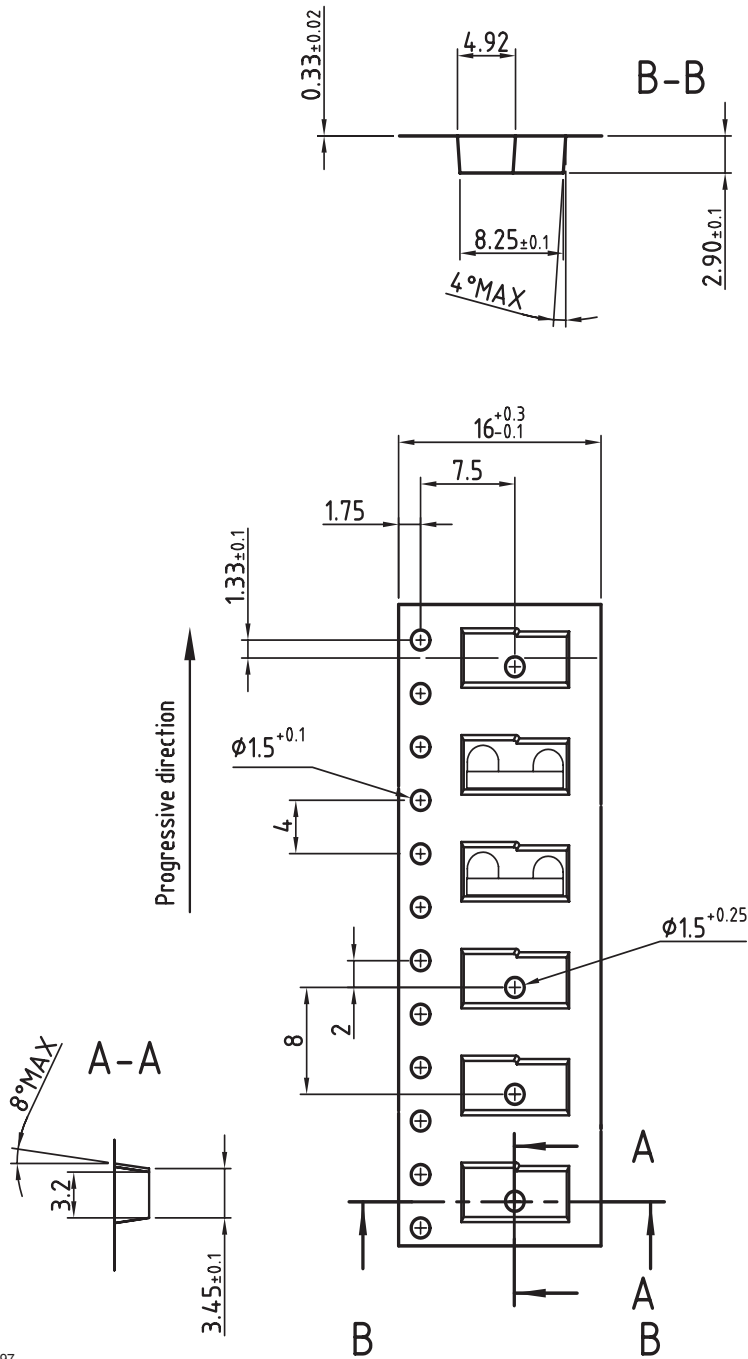
## Reel Dimensions



14017

Tape Width	A max.	N	W <sub>1</sub> min.	W <sub>2</sub> max.	W <sub>3</sub> min.	W <sub>3</sub> max.
mm	mm	mm	mm	mm	mm	mm
16	330	50	16.4	22.4	15.9	19.4

## Tape Dimensions in mm



18297

## **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.**

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