

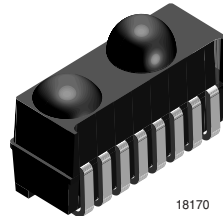
## Integrated Low Profile Transceiver Module for Telecom Applications - IrDA Standard

### Description

The miniaturized TFDU4202 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 latest IrDA® IrPHY specification up to a data rate of 115 kbit/s. At lower operating voltages up to 3.3 V the transceiver can be operated without external current limiting resistor to achieve a range > 1 m.

The added feature is a split power supply for IRED driver ( $V_{CCP}$ ) and ASIC ( $V_{CCP}$ ).

For operating only in the limited distance, low power range (20 cm/ 30 cm), TFDU4201 with built-in current control is recommended. For this device see the appropriate data sheet.



18170

### Features

- Package dimension microFace TFDU4202:  
L 7.1 mm x W 4.7 mm x H 2.8 mm
- Compatible to 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  $\mu$ A, receive mode, 0.01  $\mu$ A Shutdown
- Built-in current limitation
- Output intensity adjustable by external resistor
- Wide supply voltage range (2.4 V to 5.5 V)
- Split power supply



- 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
- Push-pull output (RXD)
- High EMI immunity
- Split power supply, transmitter and receiver can be operated from two power supplies with relaxed requirements saving costs, US Patent No. 6,157,476
- Lead (Pb)-free device
- Device in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC

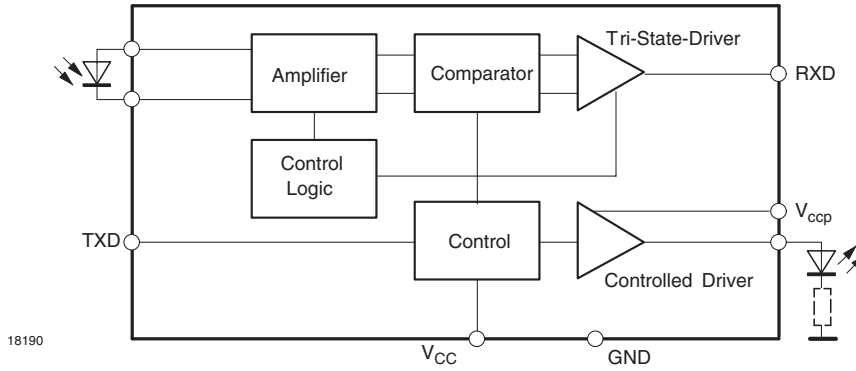
### Applications

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

### Parts Table

Part	Description	Qty / Reel
TFDU4202-TR1	Orientated in carrier tape for side view in mounting	750 pcs
TFDU4202-TR3	Orientated in carrier tape for side view in mounting	2250 pcs

## Functional Block Diagram



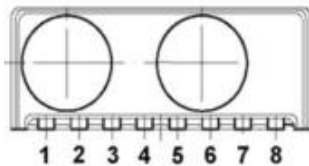
## Pin Description

Pin Number	Function	Description	I/O	Active
1	IRED GND	IRED cathode, ground		
2	IRED GND	IRED cathode, ground		
3	RXD	Output, received data, push-pull output	O	low
4	V <sub>CCP</sub>	IRED supply voltage		
5	GND	Ground		
6	GND	Ground		
7	TXD	Input, transmit data	I	high
8	V <sub>CC</sub> *)	Power supply voltage	I	high

\*) V<sub>CC</sub> is allowed to be switched off for standby with V<sub>CCP</sub> applied.

## Pinout

TFDU4202  
weight 100 mg



## Absolute Maximum Ratings

Reference Point Pin 8, unless otherwise noted.

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Supply voltage range		$V_{CC}$	- 0.5		6	V
		$V_{CCP}$	- 0.5		6	V
Input current	all pins				10	mA
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	see the chapter "Soldering conditions" for lead-bearing and Pb-free processing				260	°C
Average IRED current		$I_{IRED(DC)}$			125	mA
Repetitive pulsed IRED current	< 90µs, $t_{on}$ < 20 %	$I_{IRED(RP)}$			500	mA
Transmitter data input voltage		$V_{TXD}$	- 0.5		6	V
Receiver data output voltage		$V_{RXD}$	- 0.5		6	V

## Eye safety information

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Virtual source size	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

### Transceiver

Tested for the following parameters ( $V_{CC} = 2.4$  V to 5.5 V, - 25 °C to + 85 °C, unless otherwise stated).

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Supported data rates	base band		9.6		115.2	kbit/s
Supply voltage range	operational down to 2.0 V	$V_{CC}$	2.4		5.5	V
Supply current	$V_{CC} = 2.4$ V to 5.5 V, $E_e = 0$ , receive mode, full temperature range	$I_S$		65	100	µA
	$V_{CC} = 2.4$ V to 5.5 V, 10 klx sunlight, receive mode, full temperature range, no signal	$I_S$		70	100	µA
	$V_{CC} = 2.7$ V, $V_{CCP} = 2.7$ V, 115.2 kbit/s transmission, receive mode, nose to nose operation	$I_S$		1		mA
Supply current at $V_{CCP}$	shutdown mode, entire temperature range 20 °C	$I_{Sshdwn}$		0.02	1	µA
	$V_{CC} = 0$ V, entire temperature range 20 °C	$I_{Sshdwn}$			10	nA
IRED peak current transmitting	$I_e = 40$ mW/sr, no external resistor $V_{CCP} = 2.7$ V, SIR standard	$I_{Str}$			360	mA
Transceiver 'power on' settling time	time from switching on $V_{CC}$ to established specified operation				1	ms

## Optoelectronic Characteristics

## Receiver

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

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Minimum detection threshold irradiance (logic high receiver input irradiance)	$ \alpha  \leq \pm 15^{\circ}$ , $V_{CC} = 2.4\text{ V to }5.5\text{ V}$	$E_{e, \min}$		25 (2.5)	50 (5)	$\text{mW/m}^2$ $(\mu\text{W/cm}^2)$
	2.0 V, 25 °C tested	$E_{e, \min}$		50	100	$\text{mW/m}^2$
Maximum detection threshold irradiance	$ \alpha  \leq \pm 90^{\circ}$ , $V_{CC} = 5\text{ V}$	$E_{e, \max}$	3300 (330)	5000 (500)		$\text{W/m}^2$ $(\text{mW/cm}^2)$
	$ \alpha  \leq \pm 90^{\circ}$ , $V_{CC} = 3\text{ V}$	$E_{e, \max}$	8000 (800)	15000 (1500)		$\text{W/m}^2$ $(\text{mW/cm}^2)$
Logic low receiver input irradiance		$E_{e, \max, \text{low}}$			4 (0.4)	$\text{mW/m}^2$ $(\mu\text{W/cm}^2)$
		$E_{e, \max, \text{low}}$				$\mu\text{W/m}^2$
Output voltage RXD	active, $C = 15\text{ pF}$	$V_{OL}$	0		0.5	V
	non active, $C = 15\text{ pF}$	$V_{OH}$	$V_{CC} - 0.5$			V
Output current RXD	$V_{OL} < 0.5\text{ V}$				4	mA
Rise time at load	$C = 15\text{ pF}$ , $R = 2.2\text{ k}\Omega$	$t_r$	20		70	ns
Fall time at load	$C = 15\text{ pF}$ , $R = 2.2\text{ k}\Omega$	$t_f$	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	$\mu\text{s}$
Power on time, SD recovery time				0.1	1	ms
Latency		$t_L$		100	200	$\mu\text{s}$

**Transmitter**

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Logic low transmitter input voltage		$V_{IL(TXD)}$	- 0.5		$0.15 \times V_{CC}$	V
Logic high transmitter input voltage		$V_{IH(TXD)}$	$0.8 \times V_{CC}$		6	V
Output radiant intensity	$I_{F1} = 320 \text{ mA}$ , $ \alpha  \leq \pm 15^\circ$ , current controlled by external resistor, voltage range 2.7 V to 5.5 V	$I_e$	45			mW/sr
Peak emission wavelength		$\lambda_p$	850		900	nm
Spectral emission bandwidth				60		nm
Optical rise/fall time	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 $\mu\text{s}$ , safety protection				25	$\mu\text{s}$
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	$\mu\text{s}$

**Truth table**

Inputs			Outputs	
$V_{CC}$	TXD	Optical input Irradiance mW/m <sup>2</sup>	RXD	Transmitter
low	x	x	low	0
high	high	x	high	$I_e$
	high $\geq 25 \mu\text{s}$	x	high	0
	low	< 4	high	0
	low	> Min. detection threshold irradiance < Max. detection threshold irradiance	x	0
	low	> Max. detection threshold irradiance	undefined	0

### Application Hints

The TFDU4202 does not need any external component when operated with a "clean" power supply. In a more noisy ambient it is recommended to add a capacitor C1 and a resistor R1 for noise suppression. A combination of a tantalum with a ceramics capacitor will be efficient to attenuate both, RF and LF. The power supply  $V_{CCP}$  must be able to source up to 550 mA current with a fast rise time. If that cannot be guaranteed an additional capacitor near pin 4 ( $V_{CCP}$ ) should be included. The value is depended on the power supply quality. A good choice between 4.7  $\mu$ F and 10  $\mu$ F.

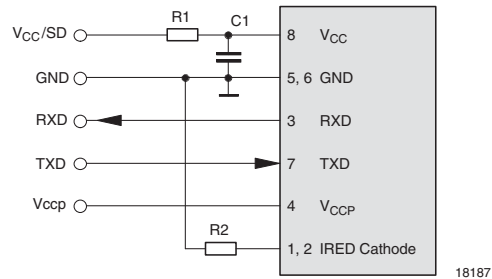
### Shut down

The TFDU4202 can be shut down (disabled) by setting the  $V_{PP}$  pin 8 low. The RXD output is floating when the devices are in shut down mode. The TXD input is high impedance in shut down mode.

### 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 TOIM4232 data sheet.

### Recommended Circuit Diagram



**Table**  
**Recommended Application Circuit Components**

Component	Recommended Value	Vishay Part Number
C1	4.7 $\mu$ F, 16 V	293D 475X9 016B 2T
R1	5 $\Omega$ ( 2 $\Omega$ to 47 $\Omega$ )	

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.

## Temperature Derating Diagram

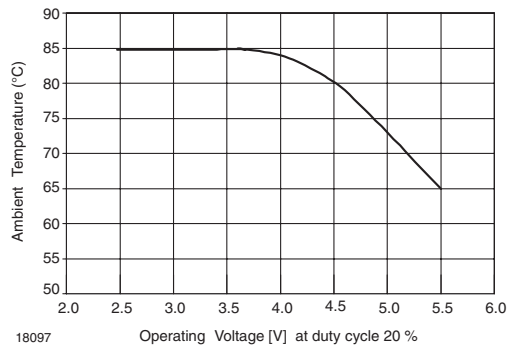


Figure 1. Temperature Derating Diagram

The temperature derating diagram 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.

## Recommended Solder Profile

### Solder Profile for Sn/Pb soldering

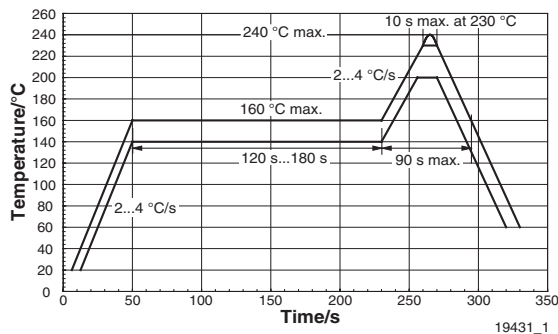


Figure 2. Recommended Solder Profile for Sn/Pb soldering

### Lead-Free, Recommended Solder Profile

The TFDU4202 is a lead-free transceiver and qualified for lead-free processing. For lead-free solder paste like Sn-(3.0 - 4.0)Ag-(0.5 - 0.9)Cu, there are two standard reflow profiles: Ramp-Soak-Spike (RSS) and Ramp-To-Spike (RTS). The Ramp-Soak-Spike profile was developed primarily for reflow ovens heated by infrared radiation. With widespread use of forced convection reflow ovens the Ramp-To-Spike profile is used increasingly. Shown below in figure 2 is Vishay's recommended profile for use with the TFDU4202 transceivers. For more details please refer to Application note: SMD Assembly Instruction.

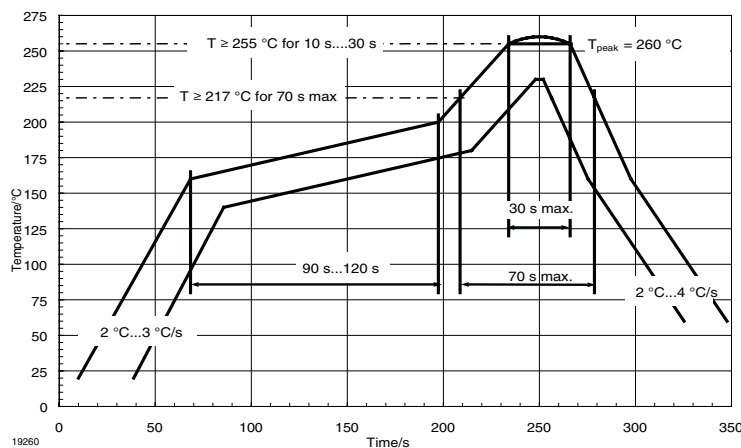


Figure 3. Solder Profile, RSS Recommendation

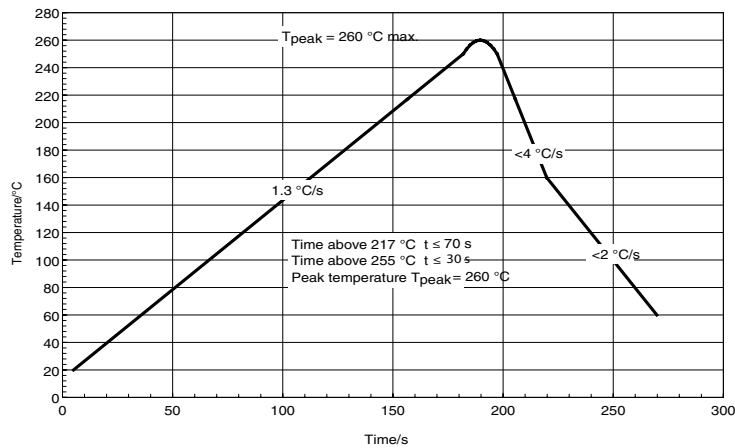
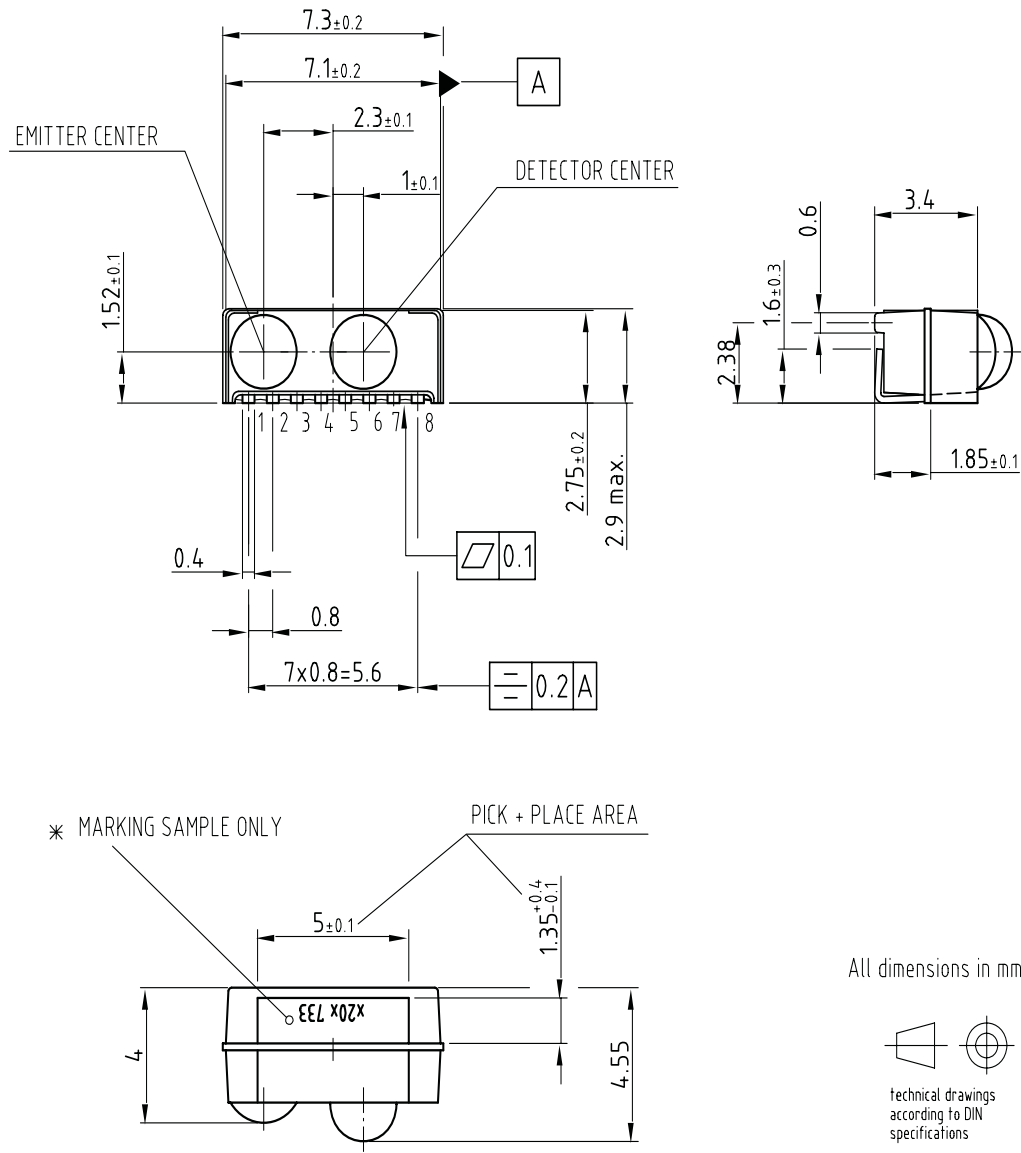


Figure 4. RTS Recommendation

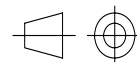
A ramp-up rate less than 0.9 °C/s is not recommended. Ramp-up rates faster than 1.3 °C/s could damage an optical part because the thermal conductivity is less than compared to a standard IC.



## Package Dimensions



All dimensions in mm



technical drawings  
according to DIN  
specifications

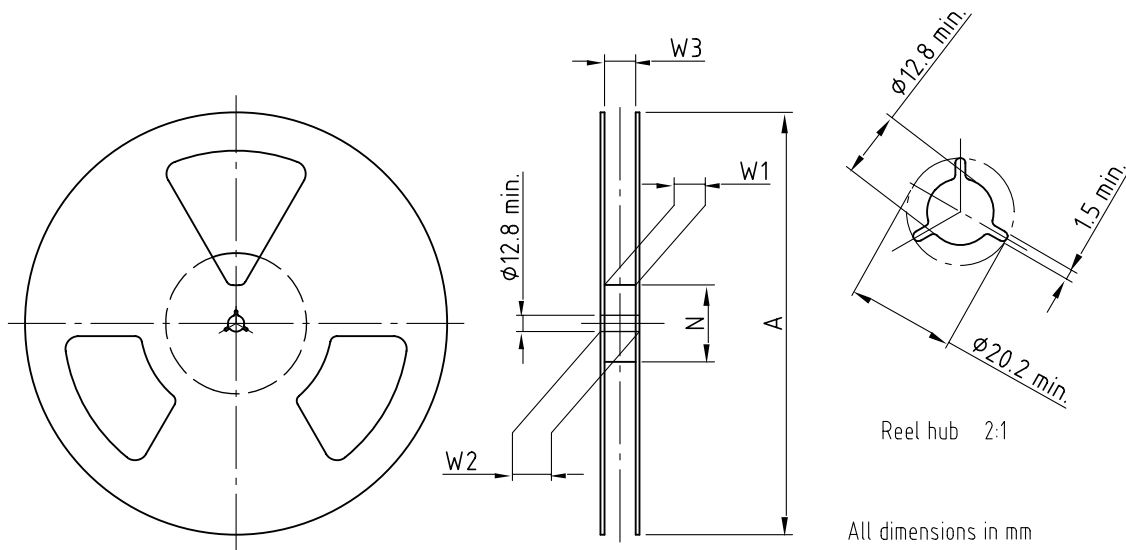
19821

\* MARKING ORIENTATION  
180 DEGREES ALLOWED

Drawing-No.: 6.550-5185.01-4  
Issue: 5; 02.09.05

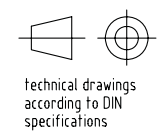
Figure 5. Package drawing, TFDU4202

## Reel Dimensions



Reel hub 2:1

All dimensions in mm



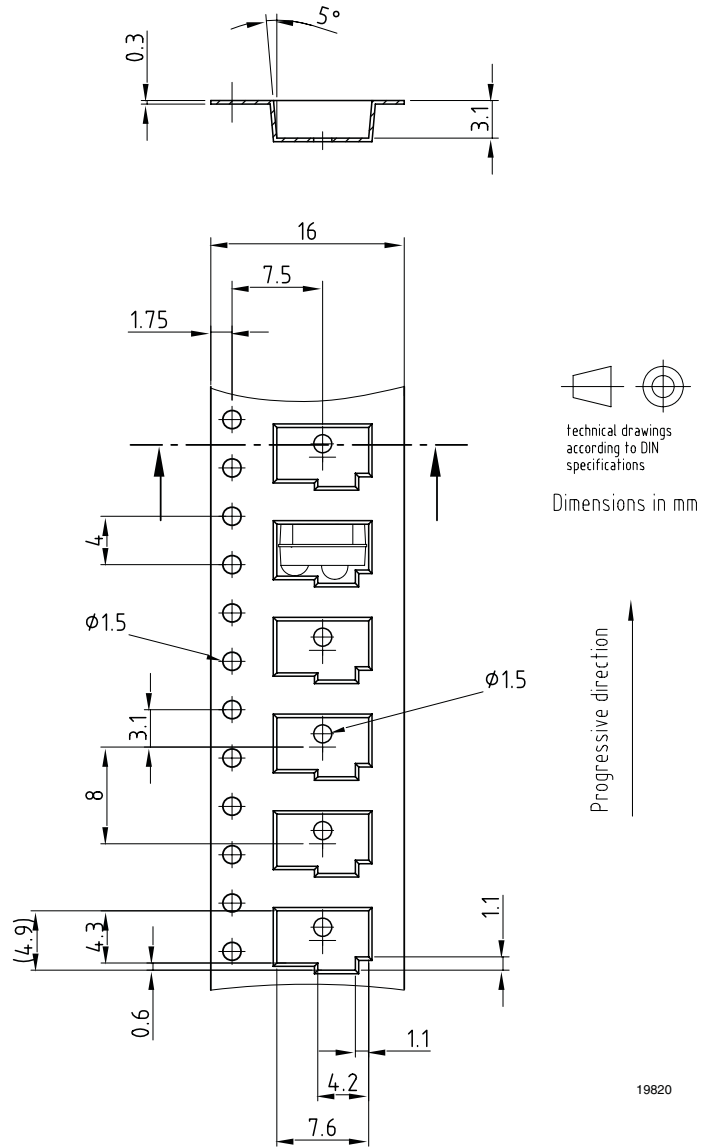
Form of the leave open of the wheel is supplier specific.

Dimension acc. to IEC EN 60 286-3

14017

mm	mm	mm	mm	mm	mm	mm
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.
16	180	60	16.4	22.4	15.9	19.4
16	330	50	16.4	22.4	15.9	19.4

## Tape Dimensions



Drawing-No.: 9.700-5227.01-4  
 Issue: 3; 03.09.99

Figure 6. Tape drawing, TFDU4202 for side view mounting

### 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.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany



### Notice

Specifications of the products displayed herein are subject to change without notice. Vishay Intertechnology, Inc., or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Vishay's terms and conditions of sale for such products, Vishay assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Vishay products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Vishay for any damages resulting from such improper use or sale.