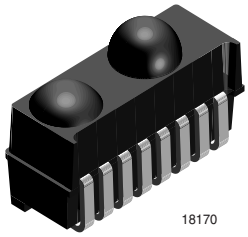
Integrated Low Profile Transceiver Module for Telecom Applications - IrDA Standard

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



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 µA, receive mode, 0.01 µA 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 oulse 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

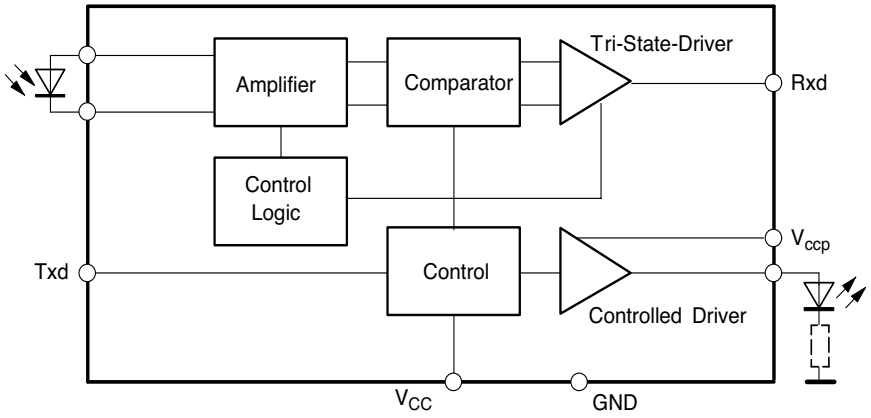
Applications

- 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



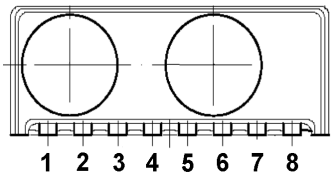
Pin Description

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_{CCP}	IRED supply voltage		
5	GND	Ground		
6	GND	Ground		
7	Txd	Input, transmit data	I	high
8	V_{CC} *)	Power supply voltage	I	high

*) V_{CC} is allowed to be switched off for standby with V_{ccp} applied.

Pinout

TFDU4202
weight 100 mg



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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	t = 20 s @ 215 °C, see Vishay Semiconductors IrDA design guide			215	240	°C
Average IRED current		$I_{IRED(DC)}$			125	mA
Repetitive pulsed IRED current	< 90 µs, 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 @ V_{ccp}	shutdown mode, entire temperature range 20 °C	$I_{Sshdown}$		0.02	1	µA
	V_{CC} = 0 V, entire temperature range 20 °C	$I_{Sshdown}$			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 V to 5.5 V, - 25 °C to + 85 °C, unless otherwise stated).

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Minimum detection threshold irradiance (logic high receiver input irradiance)	$\lvert \alpha \rvert \leq \pm 15$ °, V_{CC} = 2.4 V to 5.5 V	$E_{e, min}$		25 (2.5)	50 (5)	mW/m² (μW/cm²)
	2.0 V, 25 °C tested	$E_{e, min}$		50	100	mW/m²
Maximum detection threshold irradiance	$\lvert \alpha \rvert \leq \pm 90$ °, V_{CC} = 5 V	$E_{e, max}$	3300 (330)	5000 (500)		W/m² (mW/cm²)
	$\lvert \alpha \rvert \leq \pm 90$ °, V_{CC} = 3 V	$E_{e, max}$	8000 (800)	15000 (1500)		W/m² (mW/cm²)
Logic low receiver input irradiance		$E_{e, max,low}$			4 (0.4)	mW/m² (μW/cm²)
		$E_{e, max,low}$				μW/m²
Output voltage Rxd	active, C = 15 pF	V_{OL}	0		0.5	V
	non active, C = 15 pF	V_{OH}	V_{CC} - 0.5			V
Output current Rxd	V_{OL} < 0.5 V				4	mA
Rise time @ load	C = 15 pF, R = 2.2 kΩ	t_r	20		70	ns
Fall time @ load	C = 15 pF, R = 2.2 kΩ	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 x V_{CC} @ 40 mW/m²	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 x V_{CC} @ 40 mW/m²	t_{dt}			6.5	μs
Power on time, SD recovery time				0.1	1	ms
Latency		t_L		100	200	μs

Transmitter

Parameter	Test Conditions	Symbol	Min	Typ.	Max	Unit
Logic low transmitter input voltage		$V_{IL(Txd)}$	- 0.5		0.15 x V_{CC}	V
Logic high transmitter input voltage		$V_{IH(Txd)}$	0.8 x V_{CC}		6	V
Output radiant intensity	I_{F1} = 320 mA, $\mid \alpha \mid \leq \pm 15°$, current controlled by external resistor, voltage range 2.7 V to 5.5 V	I_e	45			mW/sr
Peak emission wavelength		λ_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 µs		1.5	1.6	1.7	µs
	input pulse duration > 25 µs, safety protection				25	µs
Output radiant intensity	logic low level				0.04	µW/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

Truth table

Inputs			Outputs	
V_{CC}	Txd	Optical input Irradiance mW/m^2	Rxd	Transmitter
low	x	x	low	0
high	high	x	high	I_e
	high ≥ 25 µs	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 µF and 10 µF.

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 µs) 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

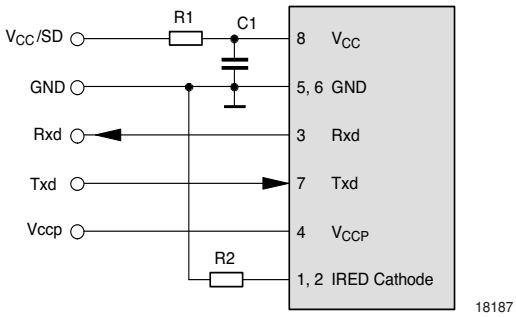


Table
Recommended Application Circuit Components

Component	Recommended Value	Vishay Part Number
C1	4.7 µF, 16 V	293D 475X9 016B 2T
R1	5 Ω (2 Ω to 47 Ω)	

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

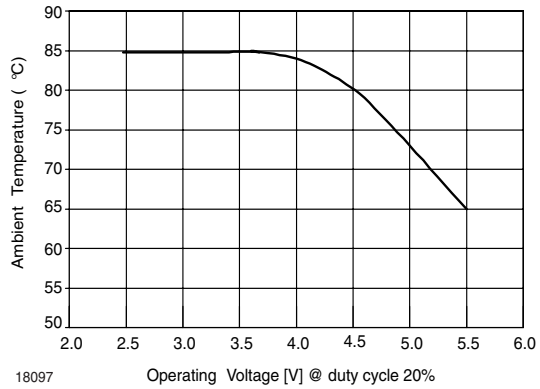


Figure 1. Temperature Derating Diagram

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

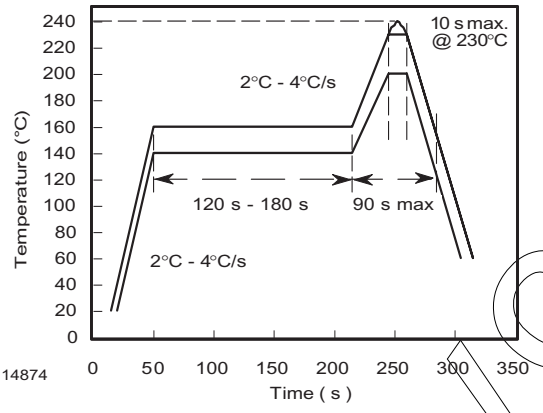


Figure 2. Recommended Solder Profile for Sn/Pb soldering

Lead-Free, Recommended Solder Profile

The TFDU4202 is a lead-free transceiver and qualified for lead-free processing. For lead-free solder paste like $Sn_{(3.0\text{-}4.0)}Ag_{(0.5\text{-}0.9)}Cu$, 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.

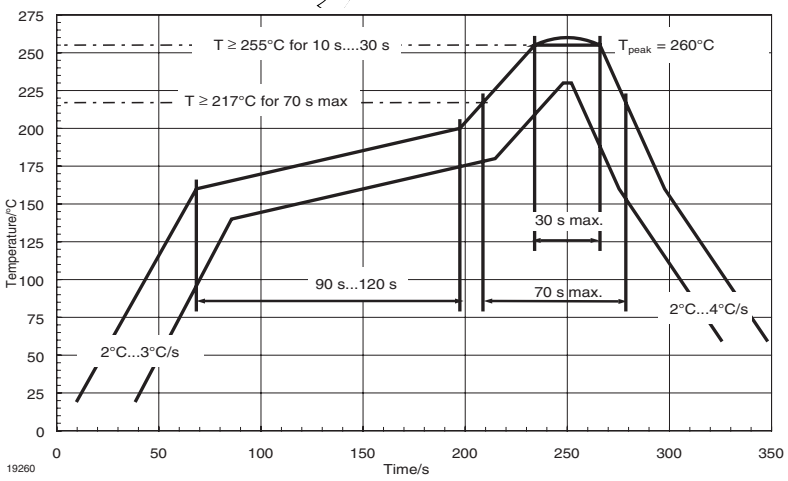


Figure 3. Solder Profile, RSS Recommendation

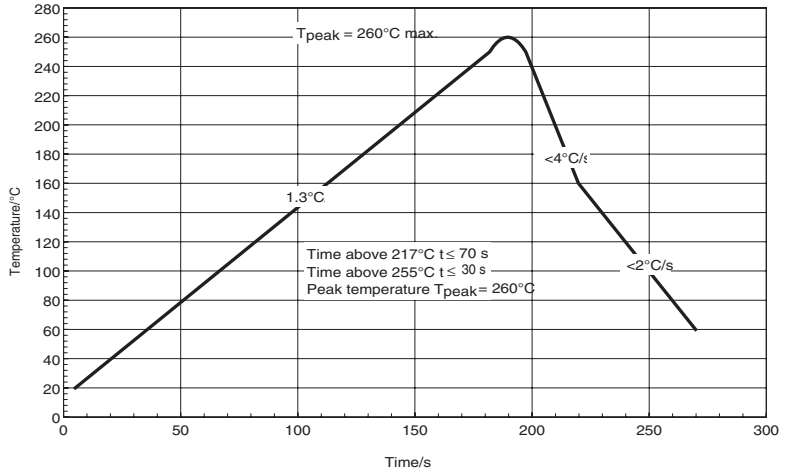
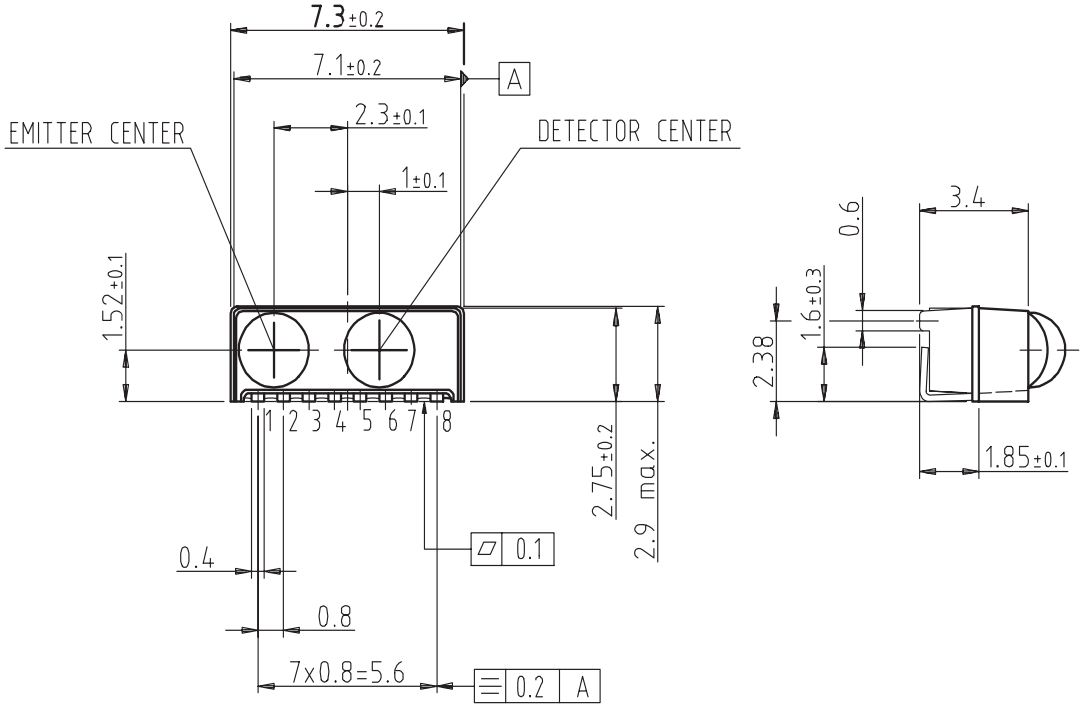
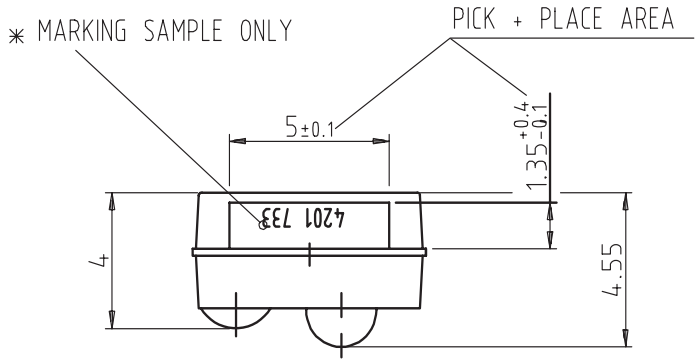


Figure 4. RTS Recommendation

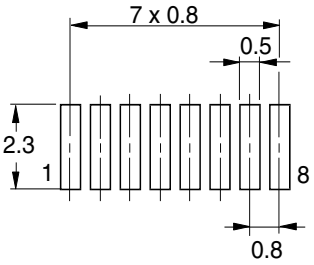
A ramp-up rate less than 0.9°C/s is not recommended. Ramp-up rates faster than 1.3°C/s could damage an optical part because the thermal conductivity is less than compared to a standard IC.

Package Dimensions in mm





technical drawings
according to DIN
specifications



* MARKING ORIENTATION
180 DEGREES ALLOWED

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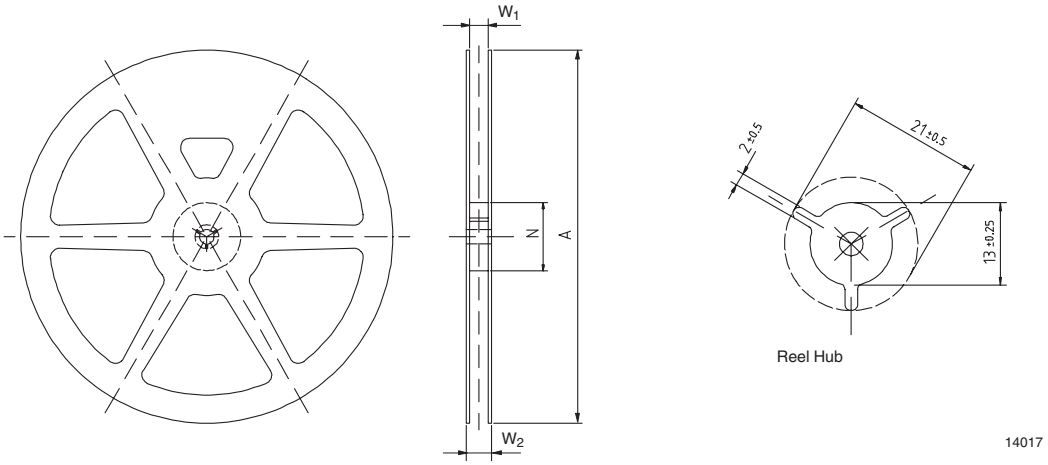
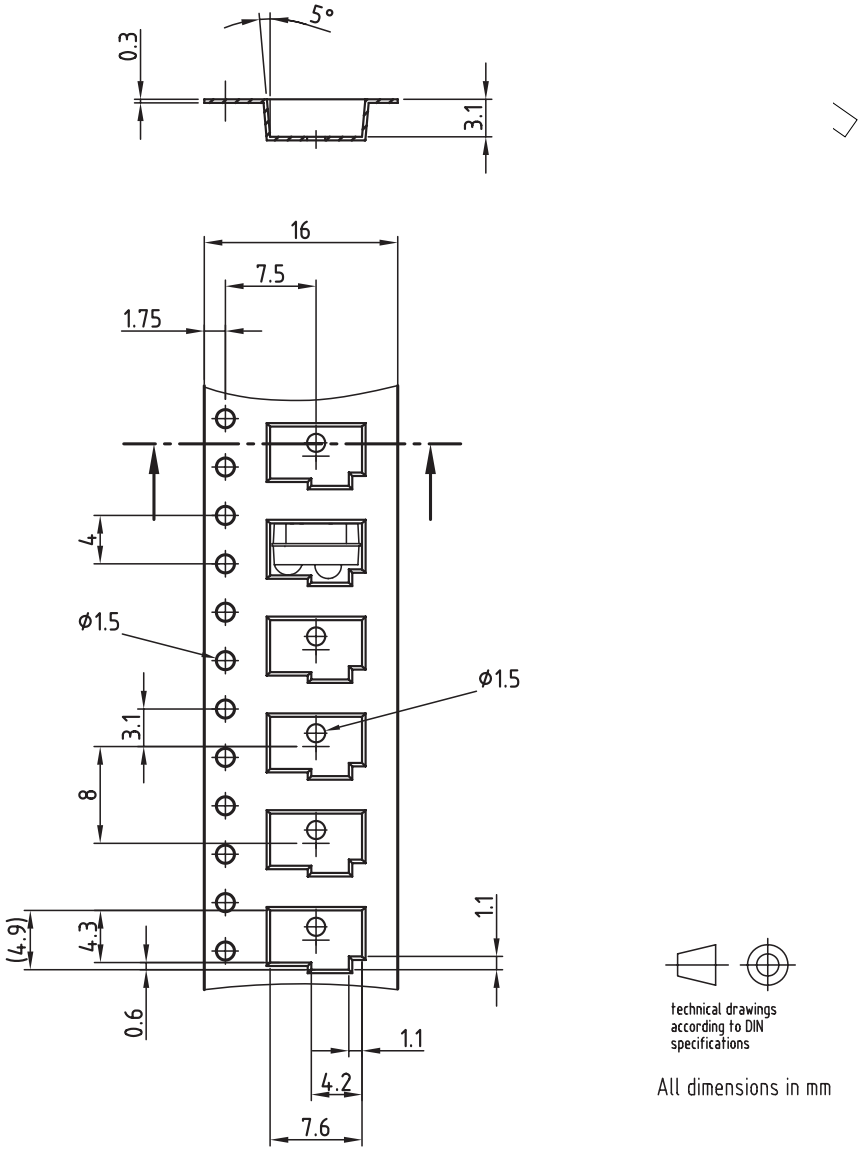
Reel Dimensions



mm	mm	mm	mm	mm	mm	mm
Tape Width	A max.	N	W_1 min.	W_2 max.	W_3 min.	W_3 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 in mm



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

Drawing refers to following types: TFDU 4201

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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 operatingsystems 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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