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Технические характеристики

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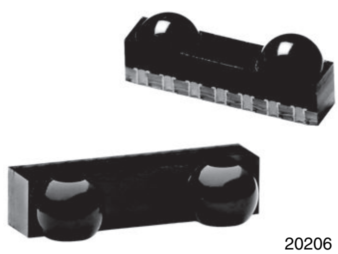
Infrared Transceiver, 9.6 kbit/s to 115.2 kbit/s (SIR)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ADDITIONAL RESOURCES

3D Models

DESCRIPTION

The TFBS4650 is one of the smallest IrDA® compliant transceivers available. It supports data rates up to 115 kbit/s. The transceiver consists of a PIN photodiode, infrared emitter, and control IC in a single package.

FEATURES

- Compliant with the IrDA physical layer IrPHY 1.4 (low power specification, 9.6 kbit/s to 115.2 kbit/s)
- Link distance: 30 cm/20 cm full 15° cone with standard or low power IrDA, respectively. Emission intensity can be set by an external resistor to increase the range for extended low power spec to > 50 cm
- Typical transmission distance to standard device: 50 cm
- Small package (L x W x H in mm): 6.8 x 2.8 x 1.6
- Low current consumption 75 μA idle at 3.6 V
- Shutdown current 10 nA typical at 25 °C
- Operates from 2.4 V to 5.5 V within specification over full temperature range from -30 °C to +85 °C
- Split power supply, emitter can be driven by a separate power supply not loading the regulated. U.S. pat. no. 6,157,476
- Qualified for lead (Pb)-free and Sn/Pb processing (MSL4)

Pb-free
e4
RoHS
COMPLIANT

APPLICATIONS

- Mobile phone
- PDAs

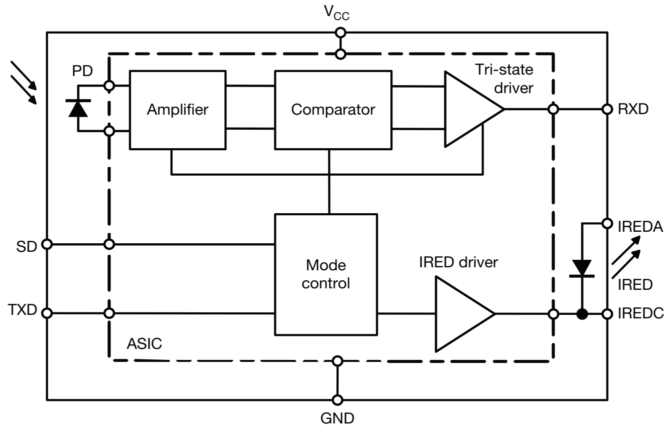
PRODUCT SUMMARY

PART NUMBER	DATA RATE (kbit/s)	DIMENSIONS H x L x W (mm x mm x mm)	LINK DISTANCE (m)	OPERATING VOLTAGE (V)	IDLE SUPPLY CURRENT (mA)
TFBS4650	115.2	1.6 x 6.8 x 2.8	0 to ≥ 0.3	2.4 to 5.5	0.075

PARTS TABLE

PART	DESCRIPTION	QTY/REEL
TFBS4650-TR1	Oriented in carrier tape for side view surface mounting	1000 pcs
TFBS4650-TR3	Oriented in carrier tape for side view surface mounting	2500 pcs
TFBS4650-TT3	Oriented in carrier tape for top view surface mounting	2500 pcs

FUNCTIONAL BLOCK DIAGRAM



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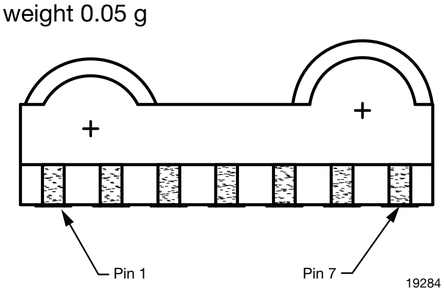
PIN DESCRIPTION				
PIN NUMBER	SYMBOL	DESCRIPTION	I/O	ACTIVE
1	IREDA	IRED anode, connected via a current limiting resistor to V_{CC2}. A separate unregulated power supply can be used.		
2	IREDC	IRED cathode, do not connect for standard operation.		
3	TXD	Transmitter data input. Setting this input above the threshold turns on the transmitter. This input switches the IRED with the maximum transmit pulse width of about 100 µs.	I	High
4	RXD	Receiver output. Normally high, goes low for a defined pulse duration with the rising edge of the optical input signal. Output is a CMOS tri-state driver, which swings between ground and V_{CC}. Receiver echoes transmitter output.	O	Low
5	SD	Shutdown. Logic low at this input enables the receiver, enables the transmitter, and un-tri-states the receiver output. It must be driven high for shutting down the transceiver.	I	High
6	V_{CC}	Power supply, 2.4 V to 5.5 V. This pin provides power for the receiver and transmitter drive section. Connect V_{CC1} via an optional filter.		
7	GND	Ground		

PINOUT

TFBS4650, bottom view

weight 0.05 g



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Definitions:

In the Vishay transceiver datasheets 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.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage range, transceiver	$0\ V < V_{CC2} < 6\ V$	V_{CC1}	-0.5	-	6	V
Supply voltage range, transmitter	$0\ V < V_{CC1} < 6\ V$	V_{CC2}	-0.5	-	6	V
Voltage at RXD	All states	V_{IN}	-0.5	-	$V_{CC} + 0.5$	V
Input voltage range, transmitter TXD	Independent of V_{CC1} or V_{CC2}	V_{IN}	-0.5	-	6	V
Input currents	For all pins, except IRED anode pin		-40	-	40	mA
Output sinking current			-	-	20	mA
Power dissipation		P_D	-	-	250	mW
Junction temperature		T_J	-	-	125	°C
Ambient temperature range (operating)		T_{amb}	-30	-	+85	°C
Storage temperature range		T_{stg}	-40	-	+100	°C
Soldering temperature [(1)]	See section "Recommended Solder Profile"		-	-	-	°C
Repetitive pulse output current	$< 90\ \mu s$, $t_{on} < 20\ \%$	I_{IRED} (RP)	-	-	500	mA
Average output current (transmitter)		I_{IRED} (DC)	-	-	100	mA
Thermal resistance junction-to-ambient	JESD51	R_{thJA}	-	300	-	K/W

Notes

- Reference point pin, ground unless otherwise noted
  Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

(1) Sn/lead (Pb)-free soldering. The product passed Vishay's standard convection reflow profile soldering test

EYE SAFETY INFORMATION

STANDARD	CLASSIFICATION
IEC/EN 60825-1 (2007-03), DIN EN 60825-1 (2008-05) "SAFETY OF LASER PRODUCTS - Part 1: equipment classification and requirements", simplified method	Class 1
IEC 62471 (2006), CIE S009 (2002) "Photobiological Safety of Lamps and Lamp Systems"	Exempt
DIRECTIVE 2006/25/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5th April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation) (19th individual directive within the meaning of article 16(1) of directive 89/391/EEC)	Exempt

Note

- Vishay transceivers operating inside the absolute maximum ratings are classified as eye safe according the above table

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, V_{CC} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
TRANSCEIVER						
Supply voltage range		V_{CC}	2.4	-	5.5	V
Dynamic supply current						
Idle, dark ambient	SD = low (< 0.8 V), E_{eamb} = 0 klx, E_e < 4 mW/m^2 -25 °C ≤ T ≤ +85 °C	I_{CC}	-	90	130	µA
Idle, dark ambient	SD = low (< 0.8 V), E_{eamb}= 0 klx, E_e < 4 mW/m^2 T = +25 °C	I_{CC}	-	75	-	µA
Peak supply current during transmission	SD = low, TXD = high	I_{ccpk}	-	2	3	mA
Shutdown supply current dark ambient	SD = high (> V_{CC} - 0.5 V), T = 25 °C, E_e = 0 klx	I_{SD}	-	-	0.1	µA
Shutdown supply current, dark ambient	SD = high (> V_{CC} - 0.5 V), -25 °C ≤ T ≤ +85 °C	I_{SD}	-	-	1	µA
Operating temperature range		T_A	-30	-	+85	°C
Input voltage low (TXD, SD)		V_{IL}	-0.5	-	0.5	V
Input voltage high	V_{CC} = 2.4 V to 5.5 V	V_{IH}	V_{CC} - 0.5	-	6	V
Input voltage threshold SD	V_{CC} = 2.4 V to 5.5 V		0.9	1.35	1.8	V
Output voltage low	V_{CC} = 2.4 V to 5.5 V C_{LOAD} = 15 pF	V_{OL}	-0.5	-	V_{CC} x 0.15	V
Output voltage high	V_{CC} = 2.4 V to 5.5 V C_{LOAD} = 15 pF	V_{OH}	V_{CC} x 0.8	-	V_{CC} + 0.5	V
RXD to V_{CC} pull-up impedance	SD = V_{CC} V_{CC} = 2.4 V to 5 V	R_{RXD}	-	500	-	kΩ
Input capacitance (TXD, SD)		C_I	-	-	6	pF

Note

- Typical values are for design aid only, not guaranteed nor subject to production testing

OPTOELECTRONIC CHARACTERISTICS (T_{amb} = 25 °C, V_{CC} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
RECEIVER						
Sensitivity: minimum irradiance E_e in angular range (1)(2)	9.6 kbit/s to 115.2 kbit/s λ = 850 nm to 900 nm	E_e	-	40 (4)	81 (8.1)	mW/m² (µW/cm²)
Maximum irradiance E_e in angular range	λ = 850 nm to 900 nm	E_e	5 (500)	-	-	kW/m² (mW/cm²)
No receiver output input irradiance (3)	According to IrDA IrPHY 1.4, appendix A1, fluorescent light specification	E_e	4 (0.4)	-	-	mW/m² (µW/cm²)
Rise time of output signal	10 % to 90 %, C_L = 15 pF	$t_{r\,(RXD)}$	20	-	100	ns
Fall time of output signal	90 % to 10 %, C_L = 15 pF	$t_{f\,(RXD)}$	20	-	100	ns
RXD pulse width of output signal, 50 % (4)	Input pulse width 1.63 µs	t_{PW}	1.7	2	2.9	µs
Receiver start up time	Power on delay		-	100	150	µs
Latency		t_L	-	50	200	µs
TRANSMITTER						
IRED operating current, current controlled	The IRED current is internally controlled but also can be reduced by an external resistor R1	I_D	200	300	400	mA
Forward voltage of built-in IRED	I_F = 300 mA	V_F	1.4	1.8	1.9	V
Output leakage IRED current	T_{amb} = 85 °C	I_{IRED}	-	-	1	µA
Output radiant intensity (5)	a = 0°, 15°, TXD = high, SD = low, V_{CC1} = 3 V, V_{CC2} = 3 V, R1 = 30 Ω (resulting in about 50 mA drive current)	I_e	5	10	25	mW/sr
Output radiant intensity (5)	a = 0°, 15°, TXD = high, SD = low, V_{CC1} = 3 V, V_{CC2} = 3 V, R1 = 0 Ω, I_F = 300 mA	I_e	30	65	150	mW/sr
Output radiant intensity (5)	V_{CC1} = 5 V, a = 0°, 15° TXD = low or SD = high (receiver is inactive as long as SD = high)	I_e	-	-	0.04	mW/sr
Saturation voltage of IRED driver	V_{CC} = 3 V, I_F = 50 mA	V_{CEsat}	-	0.4	-	V
Peak - emission wavelength		λ_p	880	886	900	nm
Spectral bandwidth		Δλ	-	45	-	nm
Optical rise time, optical fall time		t_{ropt}, t_{fopt}	20	-	100	ns
Optical output pulse duration	Input pulse width t < 30 µs Input pulse width t ≥ 30 µs	t_{opt} t_{opt}	 30	t 50	 300	µs µs
Optical output pulse duration	Input pulse width t = 1.63 µs	t_{opt}	1.45	1.61	2.2	µs
Optical overshoot			-	-	20	%

Notes

- Typical values are for design aid only, not guaranteed nor subject to production testing

(2) This parameter reflects the backlight test of the IrDA physical layer specification to guarantee immunity against light from fluorescent lamps.

(3) IrDA sensitivity definition: minimum irradiance E_e in angular range, power per unit area. The receiver must meet the BER specification while the source is operating at the minimum intensity in angular range into the minimum half-angular range at the maximum link length

(4) Maximum irradiance E_e in angular range, power per unit area. The optical delivered to the detector by a source operating at the maximum intensity in angular range at minimum link length must not cause receiver overdrive distortion and possible related link errors. If placed at the active output interface reference plane of the transmitter, the receiver must meet its bit error ratio (BER) specification. For more definitions see the document "Symbols and Terminology" on the Vishay website

(5) RXD output is edge triggered by the rising edge of the optical input signal. The output pulse duration is independent of the input pulse duration

(6) The radiant intensity can be adjusted by the external current limiting resistor to adapt the intensity to the desired value. The given value is for minimum current consumption. This transceiver can be adapted to > 50 cm operation by increasing the current to > 200 mA, e.g. operating the transceiver without current control resistor (i.e. R1 = 0 Ω) and using the internal current control

TRUTH TABLE				
INPUTS			OUTPUTS	
SD	TXD	OPTICAL INPUT IRRADIANCE mW/m²	RXD	TRANSMITTER
High	x	x	Tri-state floating with a weak pull-up to the supply voltage	0
Low	High	x	Low (echo on)	I_e
Low	High > 50 µs	x	High	0
Low	Low	< 4	High	0
Low	Low	> min. irradiance E_e < max. irradiance E_e	Low (active)	0
Low	Low	> max. irradiance E_e	x	0

RECOMMENDED CIRCUIT DIAGRAM

Operated at a clean low impedance power supply the TFBS4650 needs only one additional external component when the IRED drive current should be minimized for minimum current consumption according the low power IrDA standard. When combined operation in IrDA and remote control is intended no current limiting resistor is recommended.

However, depending on the entire system design and board layout, additional components may be required (see Fig. 1). When long wires are used for bench tests, the capacitors are mandatory for testing rise / fall time correctly.

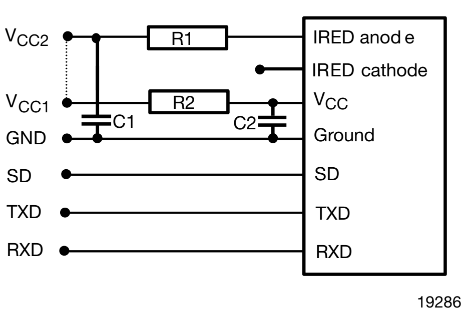


Fig. 1 - Recommended Application Circuit

The capacitor C1 is buffering the supply voltage V_{CC2} and eliminates the inductance of the power supply line. This one should be a small ceramic version or other fast capacitor to guarantee the fast rise time of the IRED current. The resistor R1 is necessary for controlling the IRED drive current when the internally controlled current is too high for the application.
Vishay transceivers integrate a sensitive receiver and a built-in power driver. The combination of both needs a careful circuit board 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 capacitor C2 combined with the resistor R2 is the low pass filter for smoothing the supply voltage.
As already stated above R2, C1 and C2 are optional and depend on the quality of the supply voltages V_{CCx} and injected noise. An unstable power supply with dropping voltage during transmission may reduce the sensitivity (and transmission range) of the transceiver.
The placement of these parts is critical. It is strongly recommended to position C2 as close as possible to the transceiver power supply pins.
When connecting the described circuit to the power supply, low impedance wiring should be used.
In case of extended wiring the inductance of the power supply can cause dynamically a voltage drop at V_{CC2}. Often some power supplies are not able to follow the fast current is rise time. In that case another 10 µF cap at V_{CC2} will be helpful.
Keep in mind that basic RF-design rules for circuit design should be taken into account. Especially longer signal lines should not be used without termination. See e.g. “The Art of Electronics” Paul Horowitz, Wienfield Hill, 1989, Cambridge University Press, ISBN: 0521370957.

RECOMMENDED APPLICATION CIRCUIT COMPONENTS	
COMPONENT	RECOMMENDED VALUE
C1, C2	0.1 µF, Ceramic Vishay part# VJ 1206 Y 104 J XXMT
R1	See table below
R2	47 Ω, 0.125 W (V_{CC1} = 3 V)

RECOMMENDED RESISTOR R1 (Ω)	
V_{CC2} (V)	MINIMIZED CURRENT CONSUMPTION, IrDA LOW POWER COMPLIANT
2.7	24
3	30
3.3	36

RECOMMENDED SOLDER PROFILES

Solder Profile for Sn/Pb Soldering

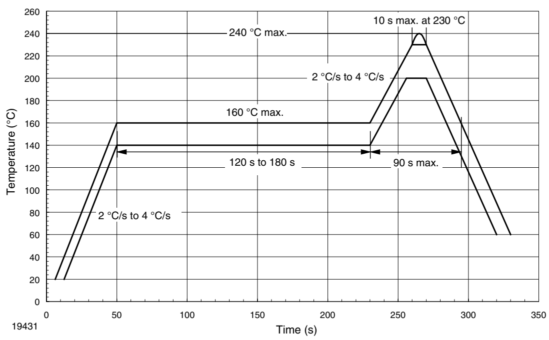


Fig. 2 - Recommended Solder Profile for Sn/Pb Soldering

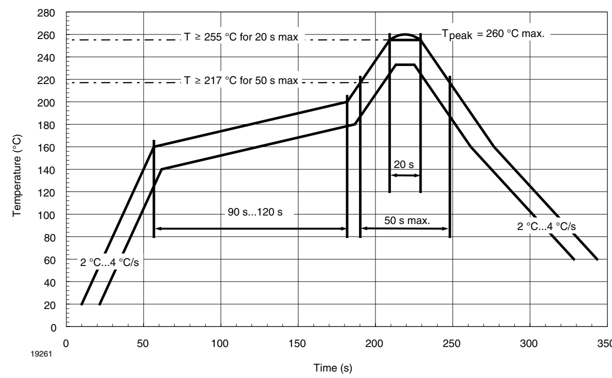


Fig. 3 - Solder Profile, RSS Recommendation

Lead (Pb)-free, Recommended Solder Profile

The TFBS4650 is a lead (Pb)-free transceiver and qualified for lead (Pb)-free processing. For lead (Pb)-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 in Fig. 3 is Vishay's recommended profiles for use with the TFBS4650 transceivers. For more details please refer to the application note "SMD Assembly Instructions".

Wave Soldering

For TFDUxxxx, TFBSxxxx, and TFBRxxxx transceiver devices wave soldering is not recommended.

Manual Soldering

Manual soldering is the standard method for lab use. However, for a production process it cannot be recommended because the risk of damage is highly dependent on the experience of the operator. Nevertheless, we added a chapter to the above mentioned application note, describing manual soldering and desoldering.

Storage

The storage and drying processes for all Vishay transceivers (TFDUxxxx, TFBSxxxx, and TFBRxxxx) are equivalent to MSL4.

The data for the drying procedure is given on labels on the packing and also in the application note "Taping, Labeling, Storage and Packing".

PACKAGE DIMENSIONS in millimeters

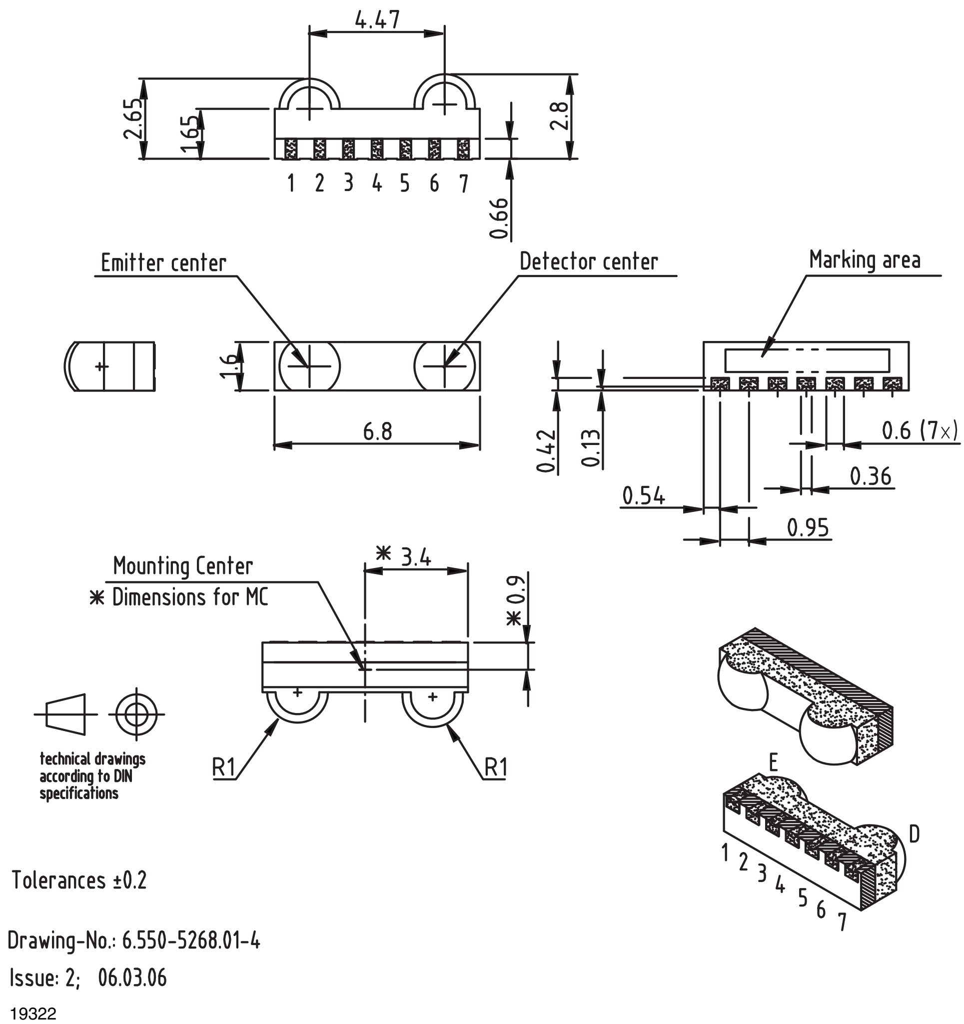


Fig. 4 - TFBS4650 Mechanical Dimensions, Tolerance ± 0.2 mm, if not otherwise mentioned

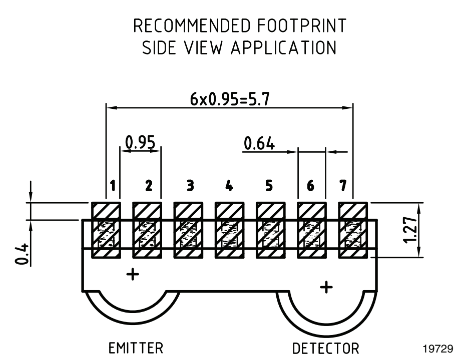
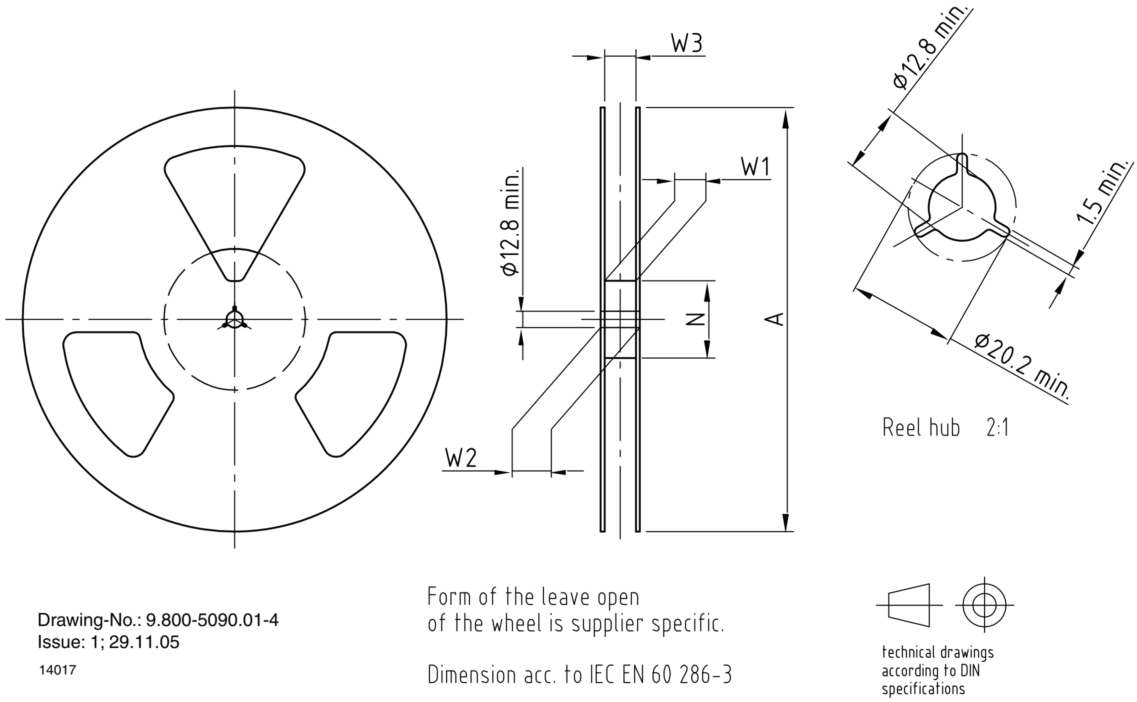


Fig. 5 - TFBS4650 Soldering Footprint, Tolerance ± 0.2 mm, if not otherwise mentioned

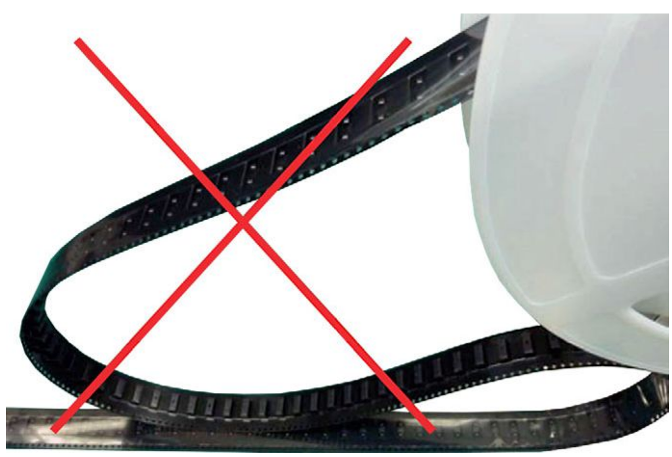
REEL DIMENSIONS in millimeters



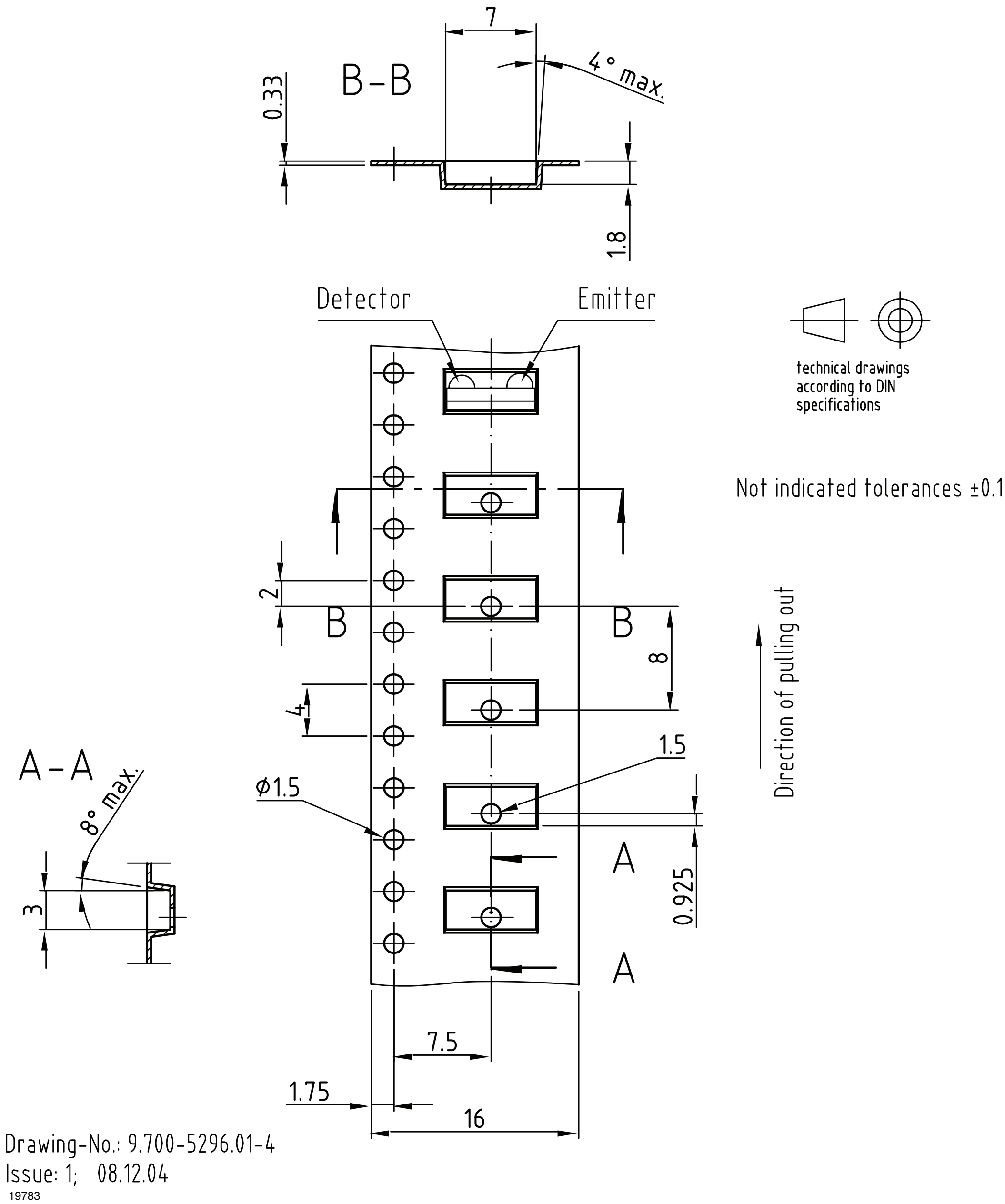
TAPE WIDTH (mm)	A MAX. (mm)	N (mm)	W_1 MIN. (mm)	W_2 MAX. (mm)	W_3 MIN. (mm)	W_3 MAX. (mm)
16	330	50	16.4	22.4	15.9	19.4
16	180	60	16.4	22.4	15.9	19.4

HANDLING PRECAUTION

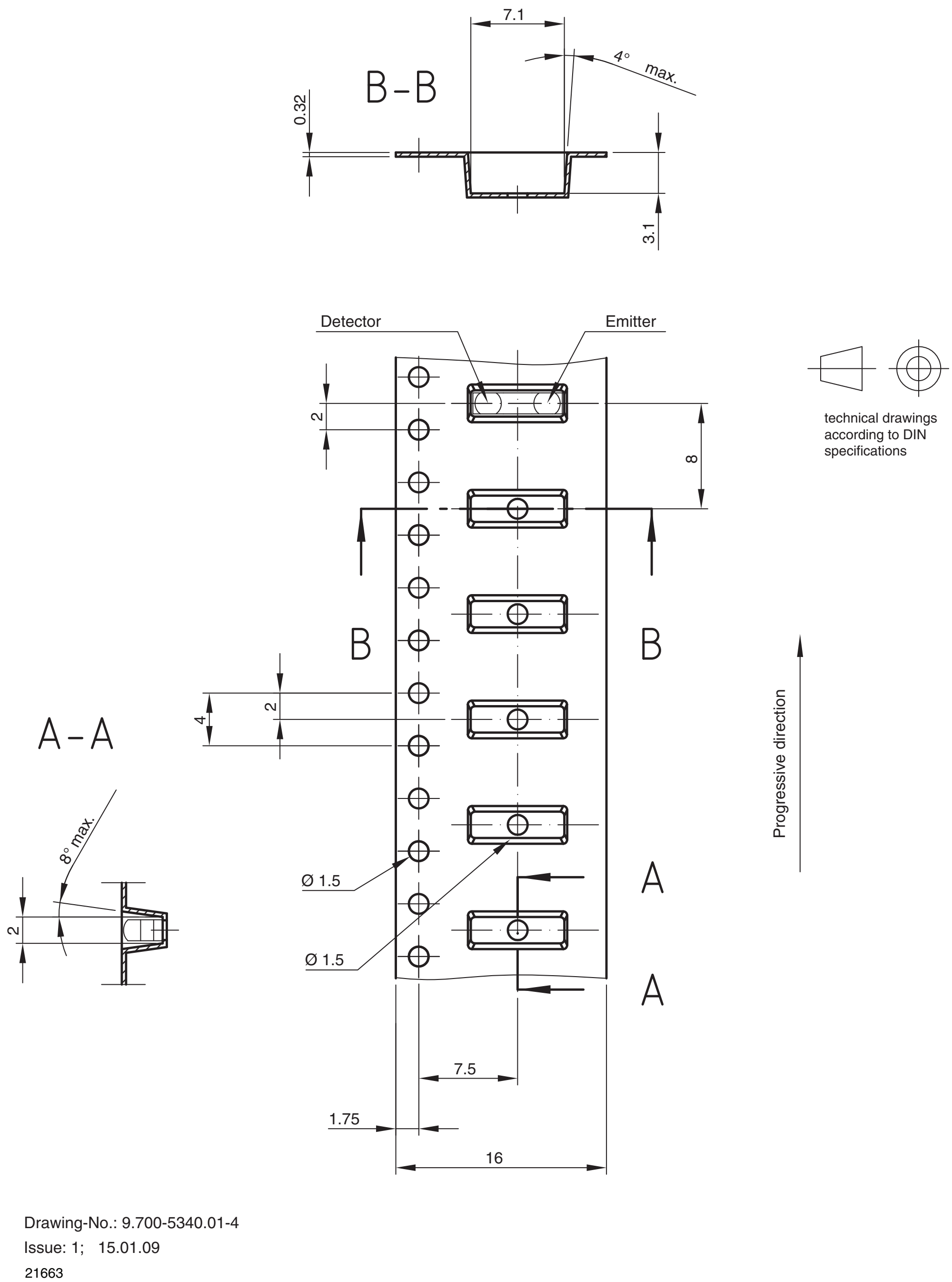
Sagging of carrier tape may cause some units to rotate and will result to pick-and-place problem. Do not allow carrier tape to sag as shown in picture below.



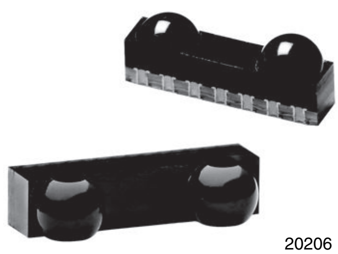
TAPE DIMENSIONS FOR TR1 AND TR3 in millimeters



TAPE DIMENSIONS FOR TT3 in millimeters



Infrared Transceiver, 9.6 kbit/s to 115.2 kbit/s (SIR)



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MEMBER IrDA

ADDITIONAL RESOURCES

3D Models

DESCRIPTION

The TFBS4652 is one of the smallest IrDA® compliant transceivers available. It supports data rates up to 115 kbit/s. The transceiver consists of a PIN photodiode, infrared emitter, and control IC in a single package.

FEATURES

Pb-free

e4

RoHS COMPLIANT

- Compliant with the IrDA physical layer IrPHY 1.4 (low power specification, 9.6 kbit/s to 115.2 kbit/s)
- Link distance: 30 cm / 20 cm full 15° cone with standard or low power IrDA, respectively. Emission intensity can be set by an external resistor to increase the range to > 50 cm
- Typical transmission distance to standard device: 50 cm
- Small package (L x W x H in mm): 6.8 x 2.8 x 1.6
- Low current consumption 75 µA idle at 3.6 V
- Operates from 2.4 V to 5.5 V within specification over full temperature range from -30 °C to +85 °C
- Split power supply, emitter can be driven by a separate power supply not loading the regulated. U.S. pat. no. 6,157,476
- Adjustable to logic I/O voltage swing from 1.5 V to 5.5 V
- Qualified for lead (Pb)-free and Sn/Pb processing (MSL4)

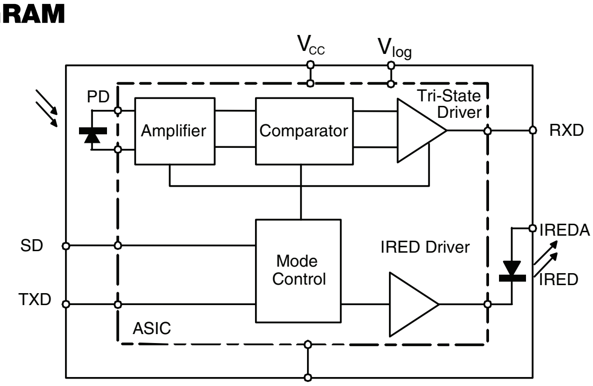
APPLICATIONS

- Mobile phone
- PDAs

PRODUCT SUMMARY					
PART NUMBER	DATA RATE (kbit/s)	DIMENSIONS H x L x W (mm x mm x mm)	LINK DISTANCE (m)	OPERATING VOLTAGE (V)	IDLE SUPPLY CURRENT (mA)
TFBS4652	115.2	1.6 x 6.8 x 2.8	0 to ≥ 0.3	2.4 to 5.5	0.075

PARTS TABLE		
PART	DESCRIPTION	QTY/REEL
TFBS4652-TR1	Oriented in carrier tape for side view surface mounting	1000 pcs
TFBS4652-TR3	Oriented in carrier tape for side view surface mounting	2500 pcs
TFBS4652-TT1	Oriented in carrier tape for top view surface mounting	1000 pcs

FUNCTIONAL BLOCK DIAGRAM



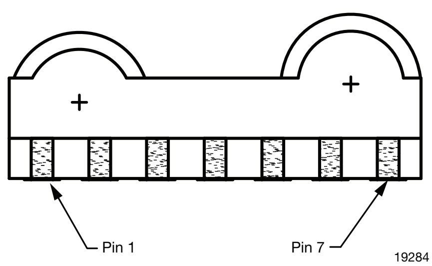
19288

PIN DESCRIPTION

PIN NUMBER	SYMBOL	DESCRIPTION	I/O	ACTIVE
1	IREDA	IRED anode, connected via a current limiting resistor to V_{CC2}. A separate unregulated power supply can be used.		
2	RXD	Receiver output. Normally high, goes low for a defined pulse duration with the rising edge of the optical input signal. Output is a CMOS tri-state driver, which swings between ground and V_{logic}. Receiver echoes transmitter output.	O	Low
3	TXD	Transmitter data input. Setting this input above the threshold turns on the transmitter. This input switches the IRED with the maximum transmit pulse width of about 100 µs.	I	High
4	SD	Shutdown. Logic low at this input enables the receiver, enables the transmitter, and un-tri-states the receiver output. It must be driven high for shutting down the transceiver.	I	High
5	V_{logic}	Reference for the logic swing of the output and the input logic levels.	I	
6	V_{CC}	Power supply, 2.4 V to 5.5 V. This pin provides power for the receiver and transmitter drive section. Connect V_{CC1} via an optional filter.		
7	GND	Ground		

PINOUT

TFBS4652, bottom view
weight 0.05 g



Definitions:

In the Vishay transceiver datasheets 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.

ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage range, transceiver	0 V < V_{CC2} < 6 V	V_{CC1}	-0.5	-	6	V
Supply voltage range, transmitter	0 V < V_{CC1} < 6 V	V_{CC2}	-0.5	-	6	V
Supply voltage range, digital supply	0 V < V_{CC1} < 6 V	V_{logic}	-0.5	-	6	V
Voltage at RXD	All states	V_{IN}	-0.5	-	V_{logic} + 0.5	V
Input voltage range, transmitter TXD	Independent of V_{dd} or V_{logic}	V_{IN}	-0.5	-	6	V
Input currents	For all pins, except IRED anode pin		-40	-	40	mA
Output sinking current			-	-	20	mA
Power dissipation		P_D	-	-	250	mW
Junction temperature		T_J	-	-	125	°C
Ambient temperature range (operating)		T_{amb}	-30	-	+85	°C
Storage temperature		T_{stg}	-40	-	+100	°C
Soldering temperature (1)	See section “Recommended Solder Profile”		-	-	260	°C
Repetitive pulse output current	< 90 µs, t_{on} < 20 %	I_{IRED} (RP)	-	-	500	mA
Average output current (transmitter)		I_{IRED} (DC)	-	-	100	mA
Thermal resistance junction-to-ambient	JESD51	R_{thJA}	-	300	-	K/W

Notes

- Reference point pin, GND unless otherwise noted
  Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

(1) Sn/lead (Pb)-free soldering. The product passed Vishay’s standard convection reflow profile soldering test

EYE SAFETY INFORMATION	
STANDARD	**CLASSIFICATION**
IEC/EN 60825-1 (2007-03), DIN EN 60825-1 (2008-05) "SAFETY OF LASER PRODUCTS - Part 1: equipment classification and requirements", simplified method	Class 1
IEC 62471 (2006), CIE S009 (2002) "Photobiological Safety of Lamps and Lamp Systems"	Exempt
DIRECTIVE 2006/25/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5th April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation) (19th individual directive within the meaning of article 16(1) of directive 89/391/EEC)	Exempt

Note

- Vishay transceivers operating inside the absolute maximum ratings are classified as eye safe according the above table

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, V_{CC} = 2.4 V to 5.5 V unless otherwise noted)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
TRANSCEIVER						
Supply voltage range		V_{CC}	2.4	-	5.5	V
Dynamic supply current						
Idle, dark ambient	SD = low (< 0.8 V), E_{eamb} = 0 klx, E_e < 4 mW/m², -25 °C ≤ T ≤ +85 °C	I_{CC}	-	90	130	µA
Idle, dark ambient	SD = low (< 0.8 V), E_{eamb} = 0 klx, E_e < 4 mW/m², T = +25 °C	I_{CC}	-	75	-	µA
Peak supply current during transmission	SD = low, TXD = high	I_{ccpk}	-	2	3	mA
Idle, dark ambient at V_{logic} - pin	SD = low (< 0.8 V), E_{eamb} = 0 klx, E_e < 4 mW/m²	I_{logic}	-	-	1	µA
Shutdown supply current, dark ambient	SD = high (> V_{logic} - 0.5 V), T = 25 °C, E_e = 0 klx	I_{SD}	-	-	0.1	µA
	SD = high (> V_{logic} - 0.5 V), T = 70 °C, E_e = 0 klx	I_{SD}	-	-	2	µA
	SD = high (> V_{logic} - 0.5 V), T = 85 °C, E_e = 0 klx	I_{SD}	-	-	3	µA
Operating temperature range		T_{amb}	-30	-	+85	°C
Output voltage low	I_{OL} = 0.2 mA, V_{CC} = 2.4 V, C_{load} = 15 pF	V_{OL}	-	0.3	-	V
Output voltage high	I_{OL} = 0.2 mA, V_{CC} = 2.4 V, C_{load} = 15 pF	V_{OH}	V_{logic} - 0.5	-	V_{logic}	V
RXD to V_{logic} pull-up impedance	SD = high (> V_{logic} - 0.5 V)	R_{RXD}	-	500	-	kΩ
Input voltage low (TXD, SD)		V_{IL}	-0.5	-	0.5	V
Input voltage high (TXD, SD)	V_{CC} = 2.4 V to 5.5 V	V_{IH}	V_{logic} - 0.5	-	6	V
Input voltage threshold SD	V_{CC} = 2.4 V to 5.5 V		0.9	0.5 x V_{logic}	0.66 x V_{logic}	V
Input capacitance (TXD, SD)		C_I	-	-	6	pF

Note

- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

OPTOELECTRONIC CHARACTERISTICS						
PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
RECEIVER						
Sensitivity: minimum irradiance E_e in angular range [1][2]	9.6 kbit/s to 115.2 kbit/s λ = 850 nm to 900 nm	E_e	-	40 (4)	81 (8.1)	mW/m² (µW/cm²)
Maximum irradiance E_e in angular range [3]	λ = 850 nm to 900 nm	E_e	5 (500)	-	-	kW/m² (mW/cm²)
No output receiver input irradiance	According to IrDA IrPHY 1.4, appendix A1, fluorescent light specification	E_e	4 (0.4)	-	-	mW/m² (µW/cm²)
Rise time of output signal	10 % to 90 %, C_L = 15 pF	$t_{r\,(RXD)}$	20	-	100	ns
Fall time of output signal	90 % to 10 %, C_L = 15 pF	$t_{f\,(RXD)}$	20	-	100	ns
RXD pulse width of output signal, 50 % [4]	Input pulse width 1.63 µs	t_{PW}	1.7	-	2.9	µs
Receiver start up time	Power on delay		-	100	150	µs
Latency		t_L	30	50	100	µs
TRANSMITTER						
IRED operating current, current controlled	The IRED current is internally controlled but also can be reduced by an external resistor R1	I_D	200	300	400	mA
Forward voltage of built-in IRED	I_F = 300 mA	V_F	1.4	1.8	1.9	V
Output leakage IRED current	T_{amb} = 85°C	I_{IRED}	-	-	1	µA
Output radiant intensity [5]	a = 0°, 15°, TXD = high, SD = low, V_{CC1} = 3 V, V_{CC2} = 3 V, R1 = 30 Ω (resulting in about 50 mA drive current)	I_e	5	10	25	mW/sr
Output radiant intensity [5]	a = 0°, 15°, TXD = high, SD = low, V_{CC1} = 3 V, V_{CC2} = 3 V, R1 = 0 Ω, I_F = 300 mA	I_e	30	65	150	mW/sr
Output radiant intensity [5]	V_{CC1} = 5 V, a = 0°, 15° TXD = low or SD = high (receiver is inactive as long as SD = high)	I_e	-	-	0.0.4	mW/sr
Saturation voltage of IRED driver	V_{CC} = 3 V, I_F = 50 mA	V_{CEsat}	-	0.4	-	V
Peak - emission wavelength		λ_p	880	886	-	nm
Spectral bandwidth		$\Delta\lambda$	-	45	-	nm
Optical rise time, optical fall time		t_{ropt}, t_{fopt}	20	-	100	ns
Optical output pulse duration	Input pulse width t < 30 µs Input pulse width t ≥ 30 µs	t_{opt} t_{opt}	- 30	t 50	- 300	µs µs
Optical output pulse duration	Input pulse width t = 1.63 µs	t_{opt}	1.45	1.61	2.2	µs
Optical overshoot			-	-	20	%

Notes

- T_{amb} = 25 °C, V_{CC} = 2.4 V to 5.5 V unless otherwise noted. Typical values are for design aid only, not guaranteed nor subject to production testing

(1) This parameter reflects the backlight test of the IrDA physical layer specification to guarantee immunity against light from fluorescent lamps

(2) IrDA sensitivity definition: minimum irradiance E_e in angular range, power per unit area. The receiver must meet the BER specification while the source is operating at the minimum intensity in angular range into the minimum half-angular range at the maximum link length

(3) Maximum irradiance E_e in angular range, power per unit area. The optical delivered to the detector by a source operating at the maximum intensity in angular range at minimum link length must not cause receiver overdrive distortion and possible related link errors. If placed at the active output interface reference plane of the transmitter, the receiver must meet its bit error ratio (BER) specification. For more definitions see the document "Symbols and Terminology" on the Vishay website

(4) RXD output is edge triggered by the rising edge of the optical input signal. The output pulse duration is independent of the input pulse duration

(5) The radiant intensity can be adjusted by the external current limiting resistor to adapt the intensity to the desired value. The given value is for minimum current consumption. This transceiver can be adapted to > 50 cm operation by increasing the current to > 200 mA, e.g. operating the transceiver without current control resistor (i.e. R1 = 0 Ω) and using the internal current control

TRUTH TABLE

INPUTS			OUTPUTS	
SD	**TXD**	**OPTICAL INPUT IRRADIANCE mW/m²**	**RXD**	**TRANSMITTER**
High	x	x	Tri-state floating with a weak pull-up to the supply voltage	0
Low	High	x	Low (echo on)	I_e
Low	High > 100 µs	x	High	0
Low	Low	< 2	High	0
Low	Low	> min. irradiance E_e < max. irradiance E_e	Low (active)	0
Low	Low	> max. irradiance E_e	x	0

RECOMMENDED CIRCUIT DIAGRAM

Operated at a clean low impedance power supply the TFBS4652 needs only one additional external component when the IRED drive current should be minimized for minimum current consumption according the low power IrDA standard. When combined operation in IrDA and remote control is intended no current limiting resistor is recommended. When long wires are used for bench tests, the capacitors are mandatory for testing rise/fall time correctly.

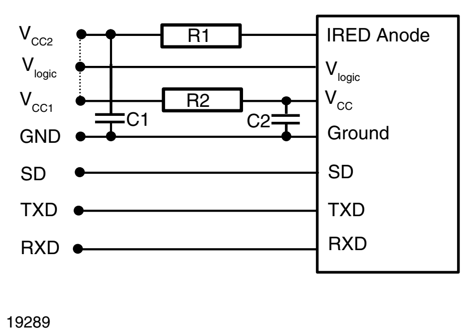


Fig. 1 - Recommended Application Circuit

The capacitor C1 is buffering the supply voltage V_{CC2} and eliminates the inductance of the power supply line. This one should be a small ceramic version or other fast capacitor to guarantee the fast rise time of the IRED current. The resistor R1 is necessary for controlling the IRED drive current when the internally controlled current is too high for the application.

Vishay transceivers integrate a sensitive receiver and a built-in power driver. The combination of both needs a careful circuit board 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 capacitor C2 combined with the resistor R2 is the low pass filter for smoothing the supply voltage.

As already stated above R2, C1 and C2 are optional and depend on the quality of the supply voltages V_{CCx} and injected noise. An unstable power supply with dropping voltage during transmission may reduce the sensitivity (and transmission range) of the transceiver.

The placement of these parts is critical. It is strongly recommended to position C2 as close as possible to the transceiver power supply pins.

When connecting the described circuit to the power supply, low impedance wiring should be used.

In case of extended wiring the inductance of the power supply can cause dynamically a voltage drop at V_{CC2}. Often some power supplies are not apply to follow the fast current is rise time. In that case another 10 µF cap at V_{CC2} will be helpful.

Keep in mind that basic RF-design rules for circuit design should be taken into account. Especially longer signal lines should not be used without termination. See e.g. "The Art of Electronics" Paul Horowitz, Wienfield Hill, 1989, Cambridge University Press, ISBN: 0521370957.

RECOMMENDED APPLICATION CIRCUIT COMPONENTS

COMPONENT	RECOMMENDED VALUE
C1, C2	0.1 µF, ceramic Vishay part# VJ 1206 Y 104 J XXMT
R1	See table below
R2	47 Ω, 0.125 W (V_{CC1} = 3 V)

RECOMMENDED RESISTOR R1 (Ω)

V_{CC2} (V)	MINIMIZED CURRENT CONSUMPTION, IrDA LOW POWER COMPLIANT
2.7	24
3	30
3.3	36

RECOMMENDED SOLDER PROFILES

Solder Profile for Sn/Pb Soldering

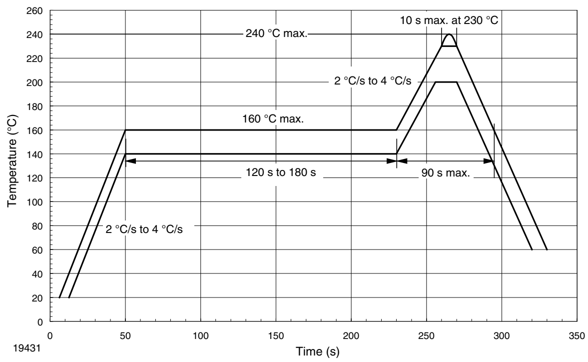


Fig. 2 - Recommended Solder Profile for Sn/Pb Soldering

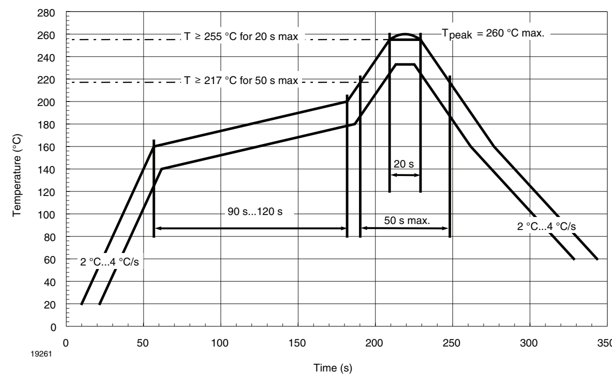


Fig. 3 - Solder Profile, RSS Recommendation

Lead (Pb)-Free, Recommended Solder Profile

The TFBS4652 is a lead (Pb)-free transceiver and qualified for lead (Pb)-free processing. For lead (Pb)-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 in figure 2 is Vishay's recommended profiles for use with the TFBS4652 transceivers. For more details please refer to the application note "SMD Assembly Instructions".

Wave Soldering

For TFDUxxxx, TFBSxxxx, and TFBRxxxx transceiver devices wave soldering is not recommended.

Manual Soldering

Manual soldering is the standard method for lab use. However, for a production process it cannot be recommended because the risk of damage is highly dependent on the experience of the operator. Nevertheless, we added a chapter to the above mentioned application note, describing manual soldering and desoldering.

Storage

The storage and drying processes for all Vishay transceivers (TFDUxxxx, TFBSxxxx, and TFBRxxxx) are equivalent to MSL4.

The data for the drying procedure is given on labels on the packing and also in the application note "Taping, Labeling, Storage and Packing".

PACKAGE DIMENSIONS in millimeters

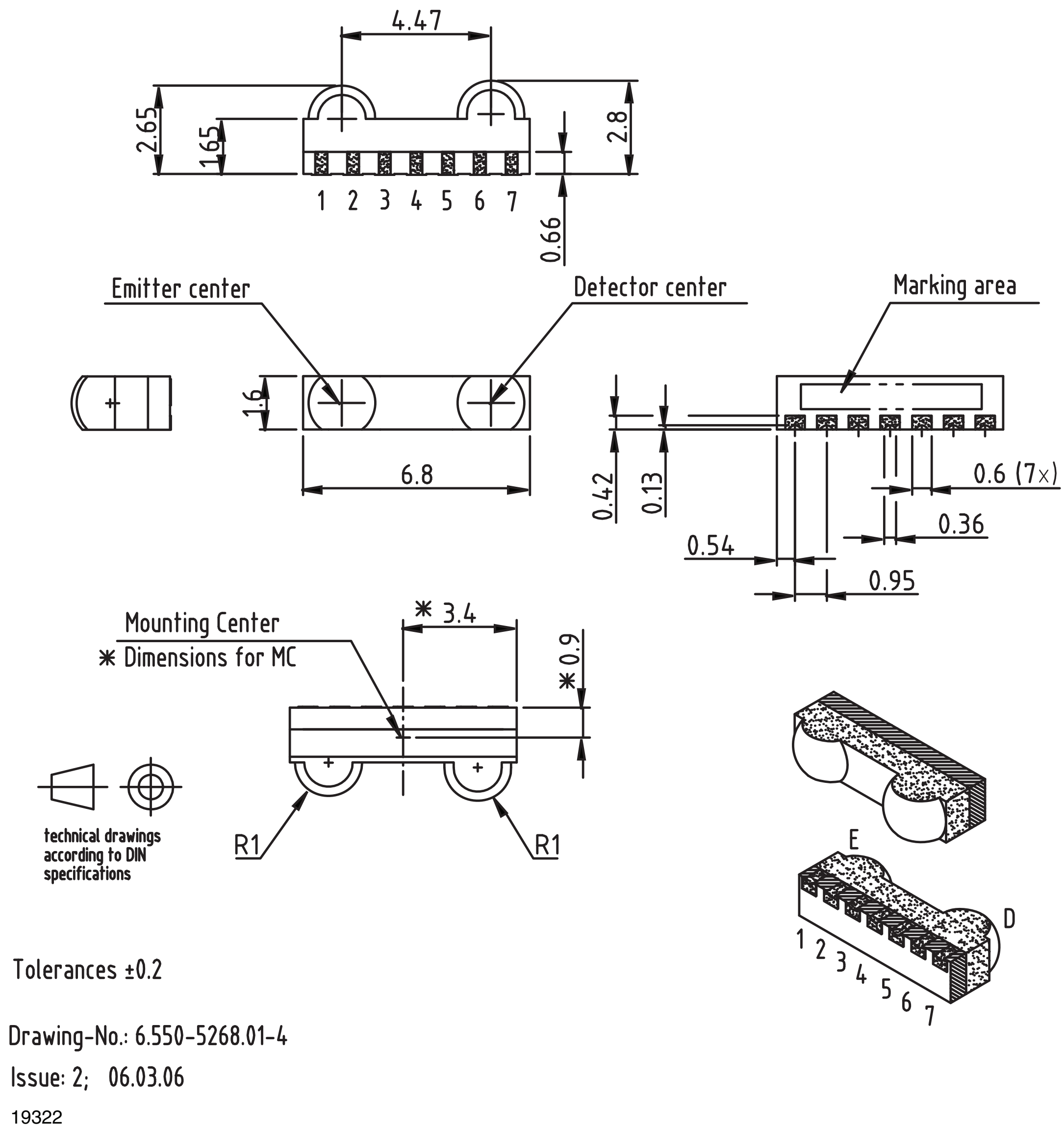


Fig. 4 - TFBS4650 Mechanical Dimensions, Tolerance ± 0.2 mm, if not otherwise mentioned

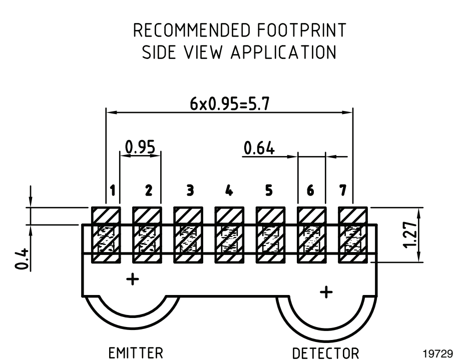
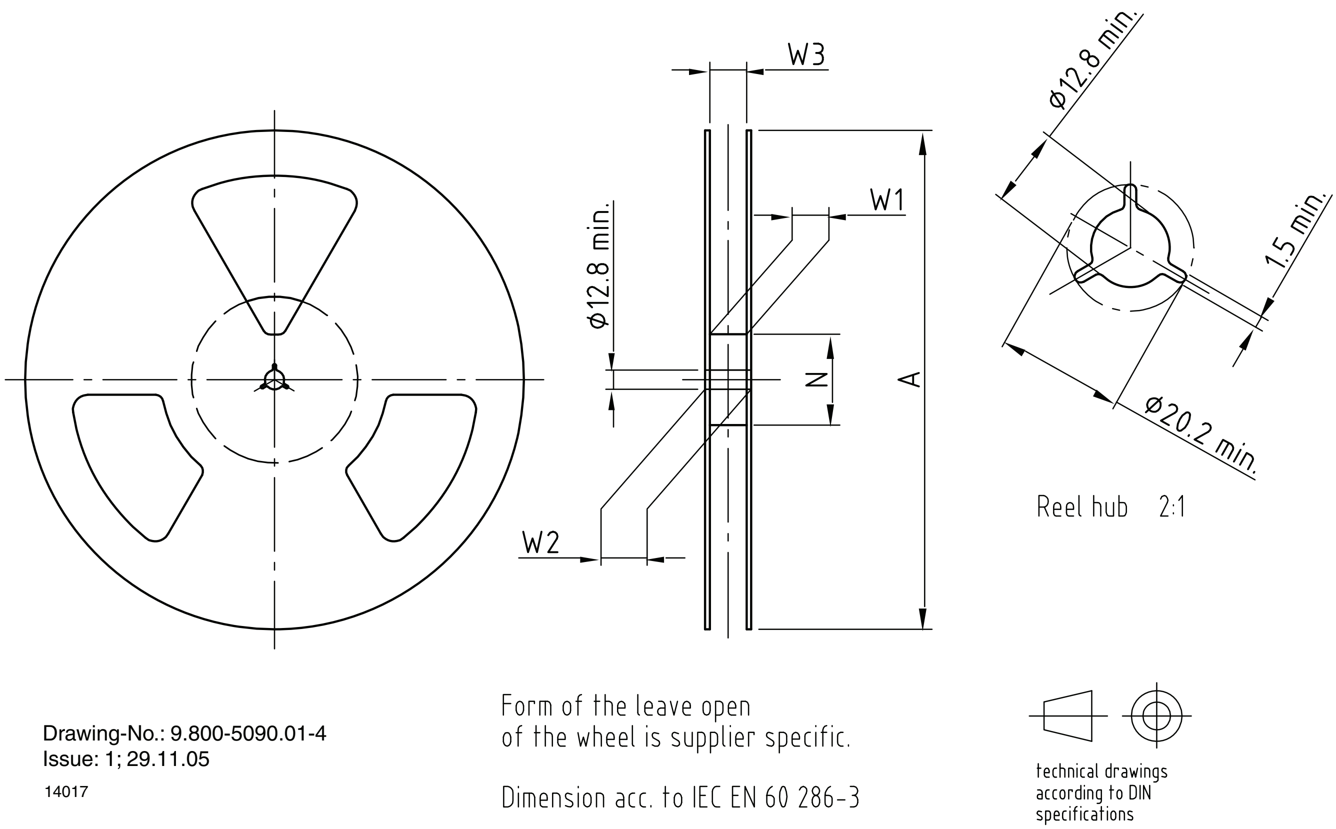


Fig. 5 - TFBS4650 Soldering Footprint, Tolerance ± 0.2 mm, if not otherwise mentioned

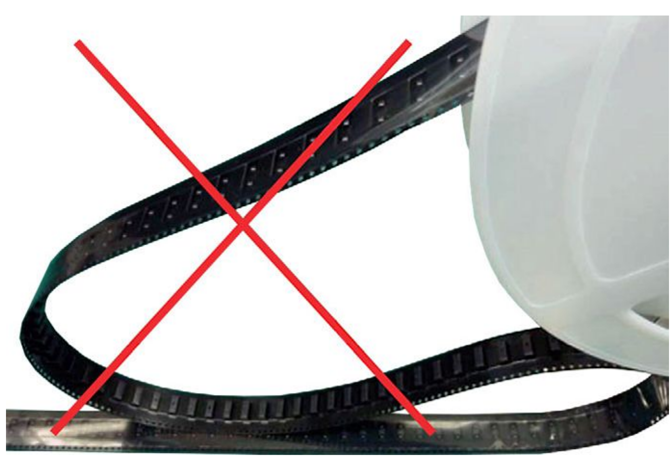
REEL DIMENSIONS in millimeters



TAPE WIDTH (mm)	A MAX. (mm)	N (mm)	W_1 MIN. (mm)	W_2 MAX. (mm)	W_3 MIN. (mm)	W_3 MAX. (mm)
16	180	60	16.4	22.4	15.9	19.4
16	330	50	16.4	22.4	15.9	19.4

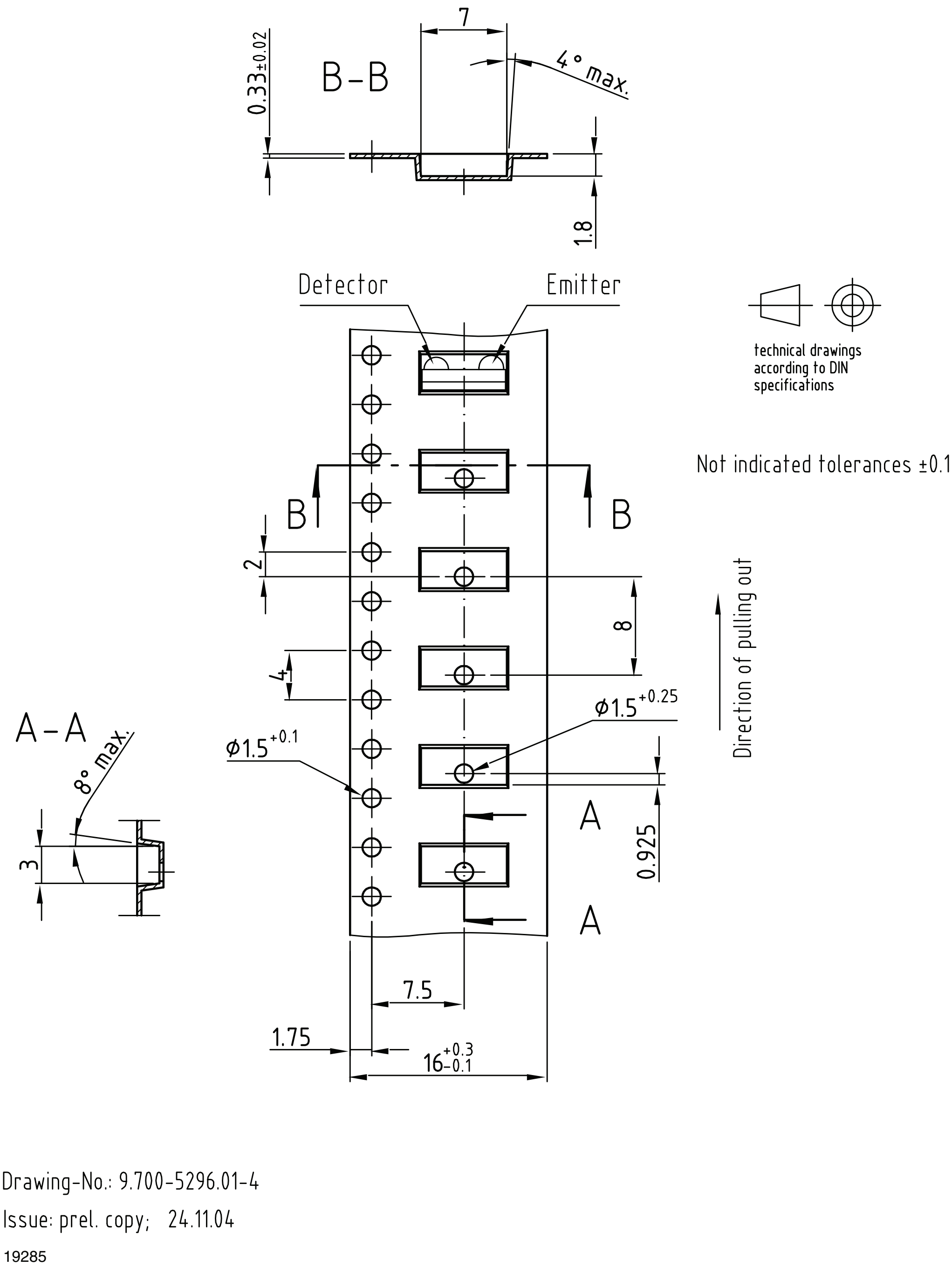
HANDLING PRECAUTION

Sagging of carrier tape may cause some units to rotate and will result to pick-and-place problem. Do not allow carrier tape to sag as shown in picture below.



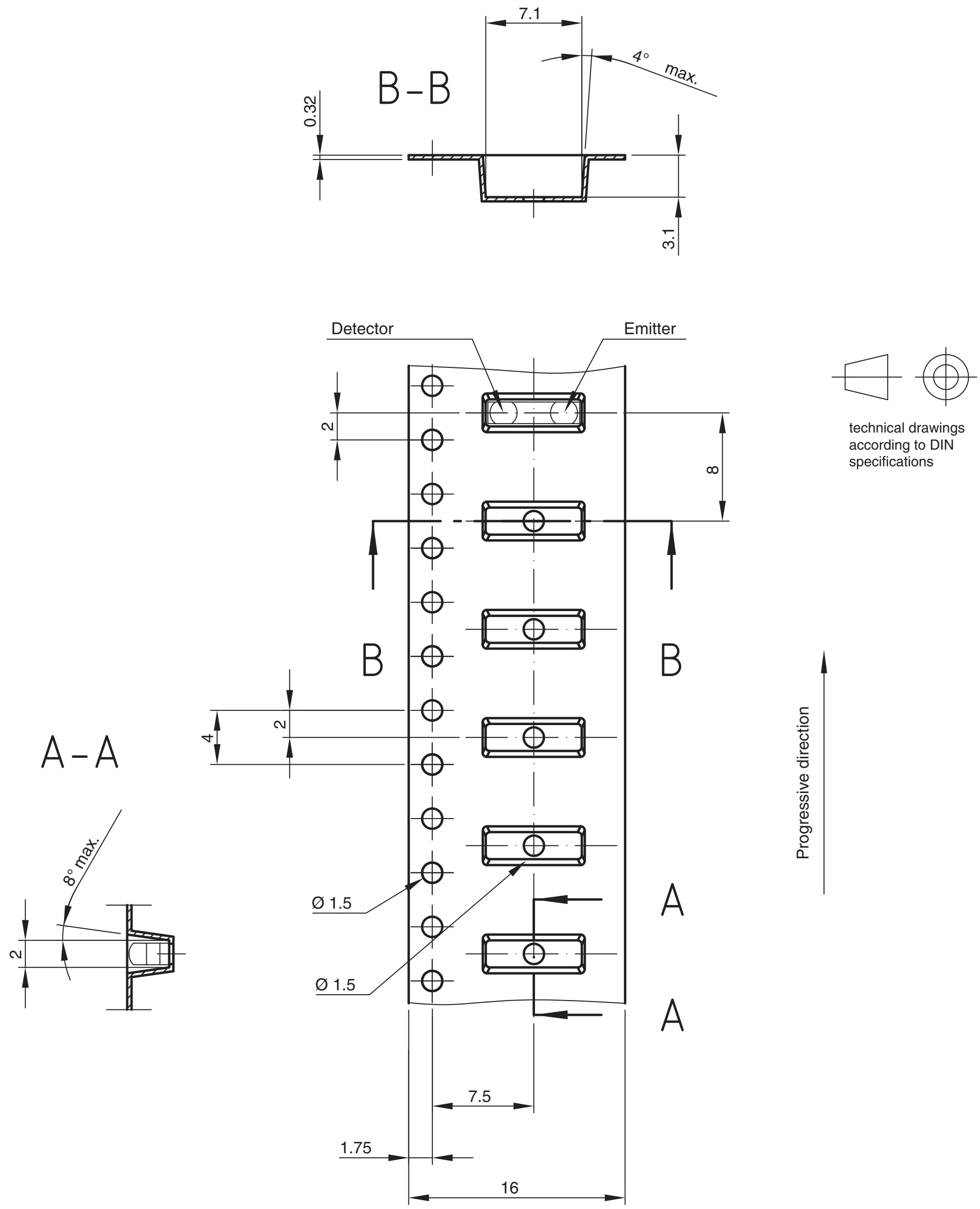
TAPE DIMENSIONS FOR TR1 AND TR3 in millimeters

Tape for Side View Oriented Parts



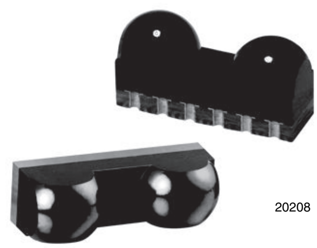
TAPE DIMENSIONS FOR TT1 in millimeters

Tape for Top View Oriented Parts



Drawing-No.: 9.700-5340.01-4
Issue: 1; 15.01.09
21663

Serial Infrared Transceiver (SIR), 115.2 kbit/s, 2.4 V to 5.5 V Operation



20208

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ADDITIONAL RESOURCES

3D Models

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 output pulse width is independent of the optical input pulse width and stays always at a fixed pulse width thus making the device optimum for standard endecs. TFBS4711 has a tri-state output and is floating in shut-down mode with a weak pull-up. 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 x L x W in mm): 1.9 x 6 x 3
- Typical link distance on-axis up to 1 m
- Battery and power management features:
  > Idle current -70 μA typical
  > Shutdown current -10 nA typical
  > Operates from 2.4 V to 5.5 V within specification over full temperature range from -30 °C to +85 °C
- Remote control - transmit distance up to 8 m
- Tri-state receiver output, floating in shutdown with a weak pull-up
- Constant RXD output pulse width (2.2 μs typical)
- Meets IrFM fast connection requirements
- Split power supply, an independent, unregulated supply for IRED anode and a well regulated supply for V_{CC}
- Directly interfaces with various super I/O and encoder / decoder devices
- Qualified for lead (Pb)-free and Sn/Pb processing (MSL4)

Pb-free

e4

RoHS COMPLIANT

APPLICATIONS

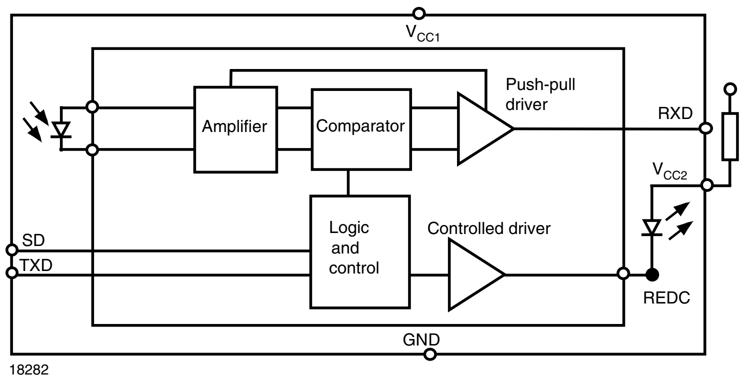
- Ideal for battery operated devices
- PDAs
- Mobile phones
- Electronic wallet (IrFM)
- Notebook computers
- Digital still and video cameras
- Printers, fax machines, photocopiers, screen projectors
- Data loggers
- External infrared adapters (dongles)
- Diagnostics systems
- Medical and industrial data collection devices
- Kiosks, POS, point and pay devices
- GPS
- Access control
- Field programming devices

PARTS TABLE

PART NUMBER	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
TFBS4711-TT1	Oriented in carrier tape for top view surface mounting	1000 pcs

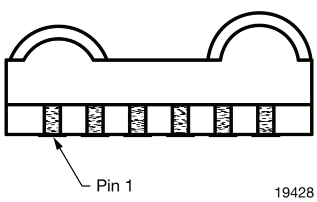
PRODUCT SUMMARY					
PART NUMBER	DATA RATE (kbit/s)	DIMENSIONS H x L x W (mm)	LINK DISTANCE (m)	OPERATING VOLTAGE (V)	IDLE SUPPLY CURRENT (mA)
TFBS4711	115.2	1.9 x 6 x 3	0 to ≥ 0.7	2.4 to 5.5	0.07

FUNCTIONAL BLOCK DIAGRAM



PINOUT

TFBS4711
weight 50 mg



Definitions:

In the Vishay transceiver datasheets 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.

PIN DESCRIPTION				
PIN NUMBER	SYMBOL	DESCRIPTION	I/O	ACTIVE
1	V_{CC2} IRED anode	Connect IRED anode directly to the power supply (V_{CC2}). IRED 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 Schmitt-Trigger input is used to transmit serial data when SD is low. An on-chip protection circuit disables the LED driver if the TXD pin is asserted for longer than 100 µs. The input threshold voltage adapts to and follows the logic voltage swing defined by the applied supply voltage	I	High
3	RXD	Received data output, push-pull CMOS driver output capable of driving standard CMOS or TTL loads. During transmission the RXD output is active and mirrors the transmit signal. No external pull-up or pull-down resistor is required. Floating with a weak pull-up of 500 kΩ (typ.) in shutdown mode. The voltage swing is defined by the applied supply voltage	O	Low
4	SD	Shutdown. The input threshold voltage adapts to and follows the logic voltage swing defined by the applied supply voltage	I	High
5	V_{CC1}	Supply voltage		
6	GND	Ground		

ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage range, transceiver	-0.3 V < V_{CC2} < 6 V	V_{CC1}	-0.5	-	+6	V
Supply voltage range, transmitter	-0.5 V < V_{CC1} < 6 V	V_{CC2}	-0.5	-	+6	V
RXD output voltage	-0.5 V < V_{CC1} < 6 V	V_{RXD}	-0.5	-	V_{CC1} + 0.5	V
Voltage at all inputs	Note: $V_{in} \geq V_{CC1}$ is allowed	V_{in}	-0.5	-	+6	V
Input current	For all pins except IRED anode pin	I_{CC}	-	-	10	mA
Output sink current			-	-	25	mA
Power dissipation		P_D	-	-	250	mW
Junction temperature		T_j	-	-	125	°C
Ambient temperature range (operating)		T_{amb}	-30	-	+85	°C
Storage temperature range		T_{stg}	-40	-	+100	°C
Soldering temperature	See recommended solder profile		-	-	260	°C
Average output current, pin 1		I_{IRED} (DC)	-	-	85	mA
Repetitive pulsed output current pin 1 to pin 2	t < 90 μs, t_{on} < 20 %	I_{IRED} (RP)	-	-	430	mA
ESD protection		V_{ESD}	1	-	-	kV
Latchup			|± 100|	-	-	mA
Thermal resistance junction-to-ambient	JESD51	R_{thJA}	-	300	-	K/W

Note

- Reference point ground, pin 6 unless otherwise noted.
  Typical values are for design aid only, not guaranteed nor subject to production testing.
  We apologize to use sometimes in our documentation the abbreviation LED and the word light emitting diode instead of infrared emitting diode (IRED) for IR-emitters. That is by definition wrong; we are here following just a bad trend

EYE SAFETY INFORMATION

STANDARD	CLASSIFICATION
IEC/EN 60825-1 (2007-03), DIN EN 60825-1 (2008-05) “SAFETY OF LASER PRODUCTS - Part 1: equipment classification and requirements”, simplified method	Class 1
IEC 62471 (2006), CIE S009 (2002) “Photobiological Safety of Lamps and Lamp Systems”	Exempt
DIRECTIVE 2006/25/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5th April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation) (19th individual directive within the meaning of article 16(1) of directive 89/391/EEC)	Exempt

Note

- Vishay transceivers operating inside the absolute maximum ratings are classified as eye safe according the above table

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
TRANSCEIVER						
Supply voltage		V_{CC1}	2.4	-	5.5	V
Operating temperature range		T_A	-30	-	+85	°C
Data rates			9.6	-	115.2	kbit/s
Idle supply current at V_{CC1} (receive mode, no signal)	SD = low, T_{amb} = -25 °C to +85 °C independent of ambient light, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V	I_{CC1}	40	70	150	µA
	SD = low, T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V	I_{CC1}	40	70	100	µA
Average dynamic supply current, transmitting	I_{IRED} = 300 mA, 20 % duty cycle	I_{CC1}	-	0.6	2	mA
Standby (SD) (1) supply current	SD = high, T_{amb} = -25 °C to +85 °C, independent of ambient light	I_{SD}	-	0.01	1	µA
RXD to V_{CC1} impedance	SD = high	R_{RXD}	400	500	600	kΩ
Input voltage low (TXD, SD)		V_{ILo}	-0.3	-	0.4	V
Input voltage high (SD)	For compliance with I_{SD} spec.	V_{IHi}	V_{CC1} - 0.3	-	6	V
Input voltage high (TXD)		V_{IHi}	V_{CC1} - 0.5	-	6	V
Input leakage current low	$V_{ILo} \leq 0.3$ V	I_{ILo}	-	0.01	10	µA
Input leakage current high	$V_{IHi} \geq V_{CC1}$ - 0.3 V	I_{IHi}	-	0.01	10	µA
Input capacitance (TXD, SD)		C_{IN}	-	-	5	pF
Output voltage low, RXD	C_{load} = 8 pF, $I_{OLo} \leq$ |+500 µA|	V_{OLo}	-	-	0.4	V
Output voltage high, RXD	I_{OH} = -200 µA	V_{OHi}	0.8 x V_{CC1}	-	V_{CC1}	V

Notes

- Typical values are for design aid only, not guaranteed nor subject to production testing

(1) SD mode becomes active when SD is set high for more than 0.2 µs. In SD mode the detector is disabled and the output disconnected

OPTOELECTRONIC CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
RECEIVER						
Minimum irradiance E_e in angular range (2)	9.6 kbit/s to 115.2 kbit/s λ = 850 nm to 900 nm, α = 0°, 15°	E_e	-	35 (3.5)	80 (8)	mW/m² (µW/cm²)
Maximum irradiance E_e in angular range (3)	λ = 850 nm to 900 nm	E_e	-	5 (500)	-	kW/m² (mW/cm²)
Maximum no detection irradiance (1)	λ = 850 nm to 900 nm, t_r, t_f < 40 ns, t_{po} = 1.6 µs at f = 115 kHz, no output signal allowed	E_e	4 (0.4)	-	-	mW/m² (µW/cm²)
Rise time of output signal	10 % to 90 %, C_L = 8 pF	$t_{r(RXD)}$	10	30	80	ns
Fall time of output signal	90 % to 10 %, C_L = 8 pF	$t_{f(RXD)}$	10	30	80	ns
RXD pulse width of output signal	Input pulse length > 1.2 µs	t_{PW}	1.7	2.2	3	µs
Stochastic jitter, leading edge	Input irradiance = 100 mW/m², ≤ 115.2 kbit/s		-	-	350	ns
Standby/shutdown delay, receiver startup time	After shutdown active or power-on		-	100	500	µs
Latency		t_L	-	50	150	µs

OPTOELECTRONIC CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
TRANSMITTER						
IRED operating current limitation	No external resistor for current limitation (5)	I_D	200	300	430	mA
Forward voltage of built-in IRED	I_F = 300 mA	V_f	1.4	1.8	1.9	V
Output leakage IRED current	TXD = 0 V, 0 < V_{CC1} < 5.5 V	I_{IRED}	-1	0.01	1	µA
Output radiant intensity	V_{CC} = 2.7 V, α = 0°, 15° TXD = high, SD = low	I_e	25	65	150	mW/sr
	V_{CC1} = 5 V, α = 0°, 15°, TXD = low or SD = high (receiver is inactive as long as SD = high)	I_e	-	-	0.04	mW/sr
Output radiant intensity, angle of half intensity		α	-	± 24	-	deg
Peak-emission wavelength (5)		λ_p	880	-	900	nm
Spectral bandwidth		$\Delta\lambda$	-	45	-	nm
Optical rise time		t_{ropt}	10	50	300	ns
Optical fall time		t_{fopt}	10	50	300	ns
Optical output pulse duration	Input pulse width 1.6 < t_{TXD} < 23 µs	t_{opt}	t_{TXD} - 0.15	-	t_{TXD} + 0.15	µs
	Input pulse width $t_{TXD} \geq$ 23 µs	t_{opt}	23	50	100	µs
Optical overshoot			-	-	25	%

Notes

- Typical values are for design aid only, not guaranteed nor subject to production testing

(1) Equivalent to IrDA background light and electromagnetic field test: fluorescent lighting immunity

(2) IrDA sensitivity definition: minimum irradiance E_e in angular range, power per unit area. The receiver must meet the BER specification while the source is operating at the minimum intensity in angular range into the minimum half-angular range at the maximum link length

(3) Maximum irradiance E_e in angular range, power per unit area. The optical delivered to the detector by a source operating at the maximum intensity in angular range at minimum link length must not cause receiver overdrive distortion and possible ralated link errors. If placed at the active output interface reference plane of the transmitter, the receiver must meet its bit error ratio (BER). For more definitions see the document "Symbols and Terminology" on the Vishay website

(4) Using an external current limiting resistor is allowed and recommended to reduce IRED intensity and operating current when current reduction is intended to operate at the IrDA low power conditions. E.g. for V_{CC2} = 3.3 V a current limiting resistor of R_S = 56 Ω will allow a power minimized operation at IrDA low power conditions

(5) Due to this wavelength restriction compared to the IrDA spec of 850 nm to 900 nm the transmitter is able to operate as source for the standard remote control applications with codes as e.g. Phillips RC5/RC6® or RECS 80

RECOMMENDED SOLDER PROFILES

Solder Profile for Sn/Pb Soldering

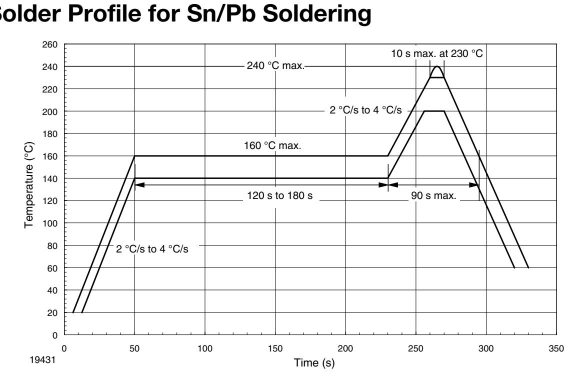


Fig. 1 - Recommended Solder Profile for Sn/Pb Soldering

Lead (Pb)-Free, Recommended Solder Profile

The TFBS4711 is a lead (Pb)-free transceiver and qualified for lead (Pb)-free processing. For lead (Pb)-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 in figure 2 is Vishay's recommended profiles for use with the TFBS4711 transceivers. For more details please refer to the application note "SMD Assembly Instructions".

Wave Soldering

For TFDUxxxx, TFBSxxxx, and TFBRxxxx transceiver devices wave soldering is not recommended.

Manual Soldering

Manual soldering is the standard method for lab use. However, for a production process it cannot be recommended because the risk of damage is highly dependent on the experience of the operator. Nevertheless, we added a chapter to the above mentioned application note, describing manual soldering and desoldering.

Storage

The storage and drying processes for all Vishay transceivers (TFDUxxxx, TFBSxxxx, and TFBRxxxx) are equivalent to MSL4.
The data for the drying procedure is given on labels on the packing and also in the application note “Taping, Labeling, Storage and Packing”.

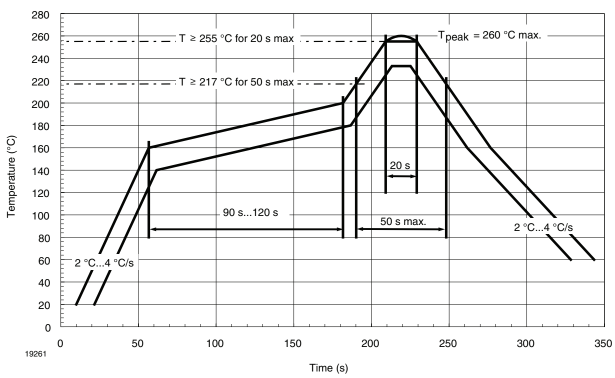


Fig. 2 - Solder Profile, RSS Recommendation

RECOMMENDED CIRCUIT DIAGRAM

Operated with a clean low impedance power supply the TFBS4711 needs no additional external components. However, depending on the entire system design and board layout, additional components may be required (see figure 1).

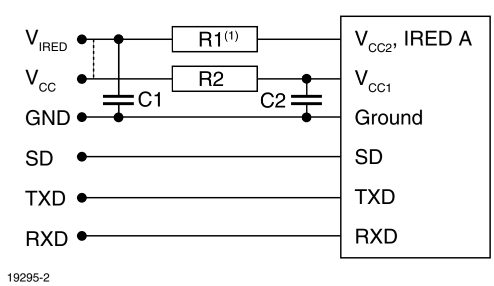


Fig. 3 - Recommended Application Circuit

Note

*) R1 is optional when reduced intensity is used

The capacitor C1 is buffering the supply voltage and eliminates the inductance of the power supply line. This one should be a Tantalum or other fast capacitor to guarantee the fast rise time of the IRED current. The resistor R1 is the current limiting resistor, which may be used to reduce the operating current to levels below the specified controlled values for saving battery power.

Vishay’s transceivers integrate a sensitive receiver and a built-in power driver. The combination of both needs a careful circuit board layout. The use of thin, long, resistive and inductive wiring should be avoided. The shutdown input must be grounded for normal operation, also when the shutdown function is not used.

TABLE 1 - RECOMMENDED APPLICATION CIRCUIT COMPONENTS

COMPONENT	RECOMMENDED VALUE	VISHAY PART NUMBER
C1	4.7 µF, 16 V	293D 475X9 016B
C2	0.1 µF, ceramic	VJ 1206 Y 104 J XXMT
R1	Depends on current to be adjusted	
R2	47 Ω, 0.125 W	CRCW-1206-47R0-F-RT1

The inputs (TXD, SD) and the output RXD should be directly connected (DC - coupled) to the I/O circuit. The capacitor C2 combined with the resistor R2 is the low pass filter for smoothing the supply voltage. R2, C1 and C2 are optional and dependent on the quality of the supply voltages V_{CC1} and injected noise. An unstable power supply with dropping voltage during transmision may reduce the sensitivity (and transmission range) of the transceiver.

The placement of these parts is critical. It is strongly recommended to position C2 as close as possible to the transceiver pins.

When extended wiring is used as in bench tests the inductance of the power supply can cause dynamically a voltage drop at V_{CC2}. Often some power supplies are not able to follow the fast current rise time. In that case another 4.7 µF (type, see table under C1) at V_{CC2} will be helpful.

Under extreme EMI conditions as placing an RF-transmitter antenna on top of the transceiver, we recommend to protect all inputs by a low-pass filter, as a minimum a 12 pF capacitor, especially at the RXD port. The transceiver itself withstands EMI at GSM frequencies above 500 V/m. When interference is observed, the wiring to the inputs picks it up. It is verified by DPI measurements that as long as the interfering RF - voltage is below the logic threshold levels of the inputs and equivalent levels at the outputs no interferences are expected.

One should keep in mind that basic RF - design rules for circuits design should be taken into account. Especially longer signal lines should not be used without termination. See e.g. “The Art of Electronics” Paul Horowitz, Winfield Hill, 1989, Cambridge University Press, ISBN: 0521370957.

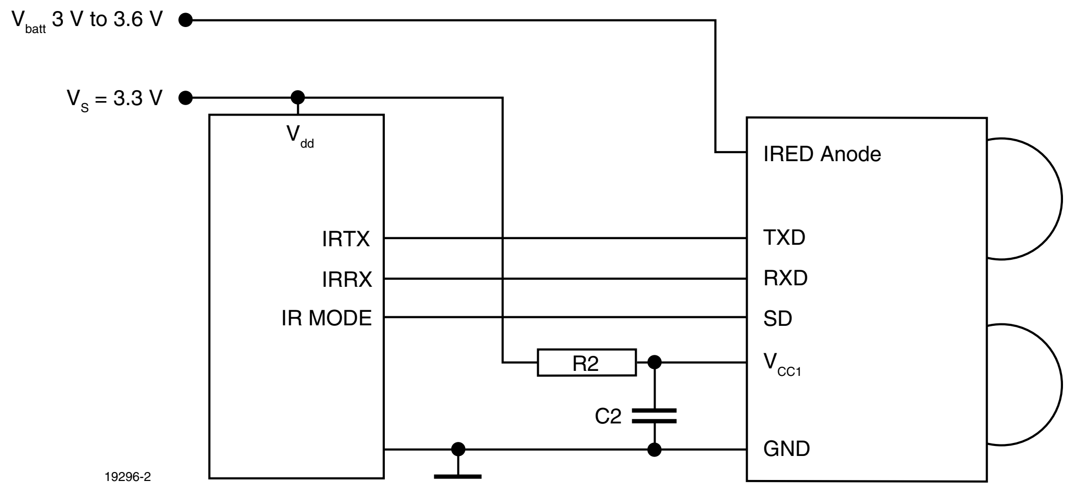


Fig. 4 - Typical Application Circuit

Figure 4 shows an example of a typical application for to work with a separate supply voltage V_S and using the transceiver with the IRED anode connected to the unregulated battery V_{batt}. This method reduces the peak load of the regulated power supply and saves therefore costs. Alternatively all supplies can also be tied to only one voltage source. R1 and C1 are not used in this case and are depending on the circuit design in most cases not necessary.

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.

For operating at RS232 ports the ENDECS TIR1000 or MCP2122 is recommended.

Note

- TFBS4711 echoes the TXD signal at the RXD output during transmission. For communication this signal is to be correctly ignored by the controller or the software. The echo signal is implemented for test purposes in mass production

TABLE 2 - TRUTH TABLE

INPUTS			OUTPUTS		REMARK
SD	TXD	OPTICAL INPUT IRRADIANCE mW/m²	RXD	TRANSMITTER	OPERATION
High > 1 ms	x	x	Weakly pulled (500 kΩ) to V_{CC1}	0	Shutdown
Low	High	x	Low (active)	I_e	Transmitting
Low	High > 100 µs	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	> min. detection threshold irradiance	Undefined	0	Overload conditions can cause unexpected outputs

PACKAGE DIMENSIONS in millimeters

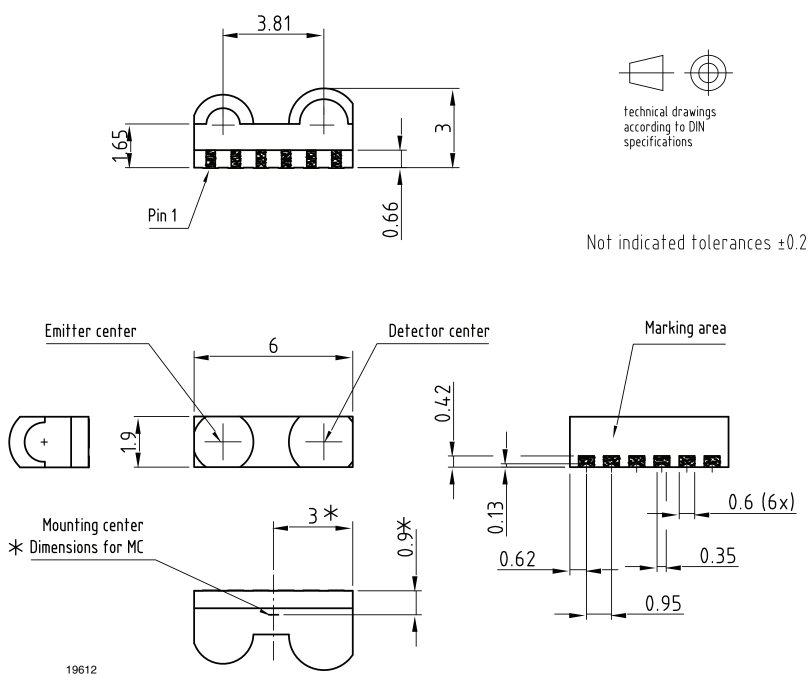


Fig. 5 - Package Drawing of TFBS4711, Tolerance of Height is +0.1 mm, -0.2 mm, other Tolerances ± 0.2 mm

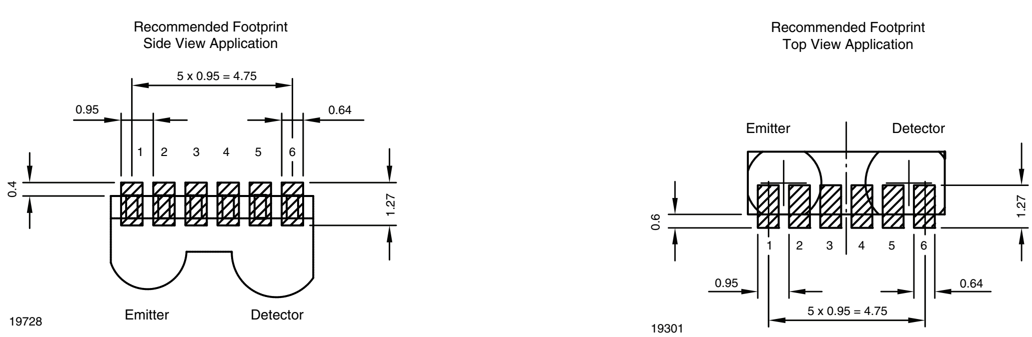
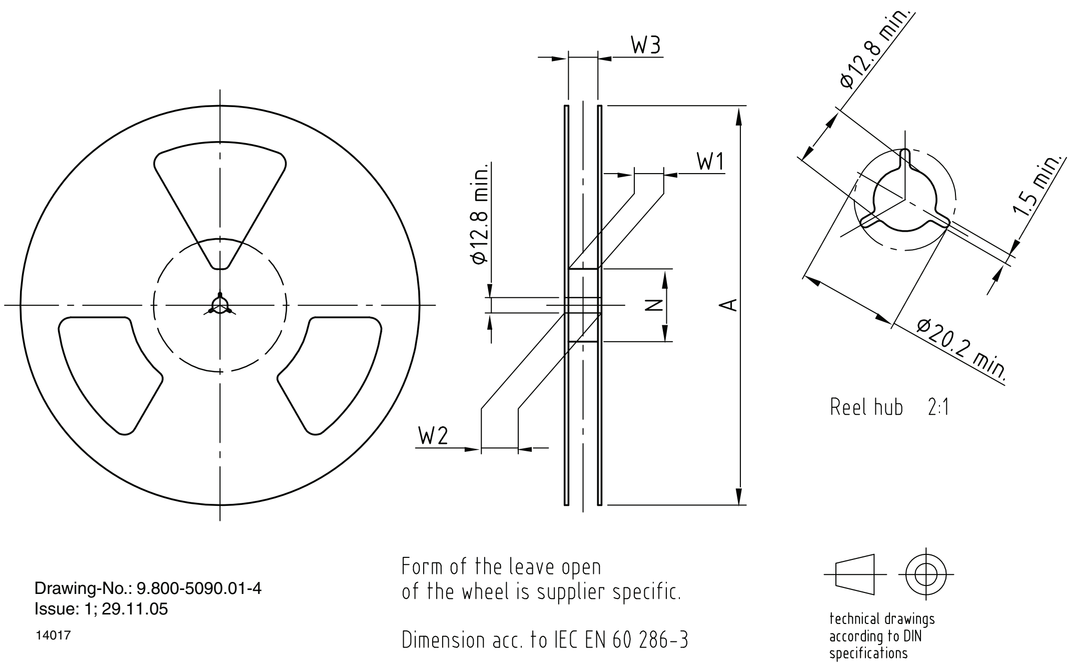


Fig. 6 - Soldering Footprints

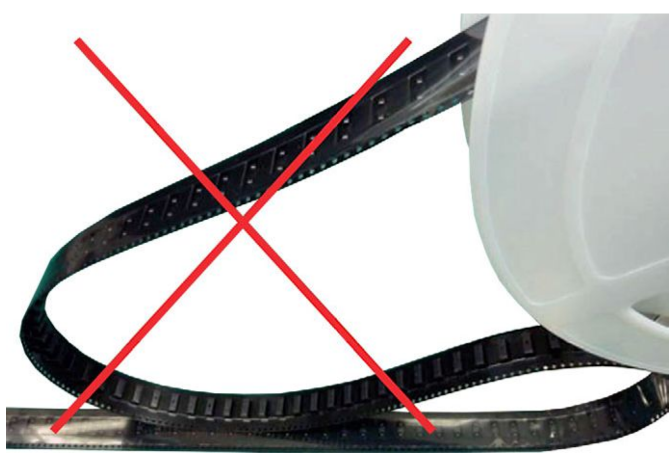
REEL DIMENSIONS in millimeters



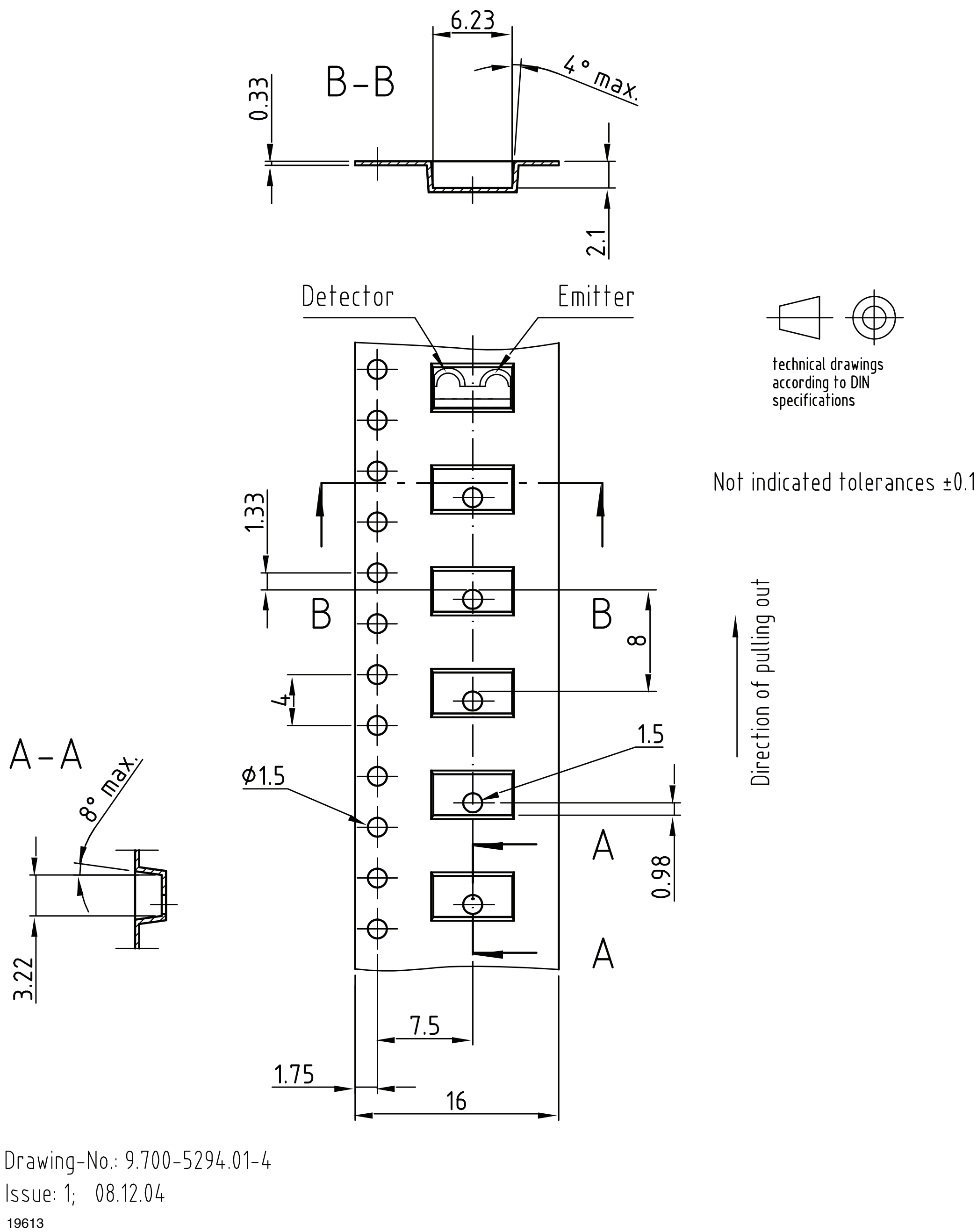
TAPE WIDTH (mm)	A MAX. (mm)	N (mm)	W_1 MIN. (mm)	W_2 MAX. (mm)	W_3 MIN. (mm)	W_3 MAX. (mm)
16	330	50	16.4	22.4	15.9	19.4
16	180	60	16.4	22.4	15.9	19.4

HANDLING PRECAUTION

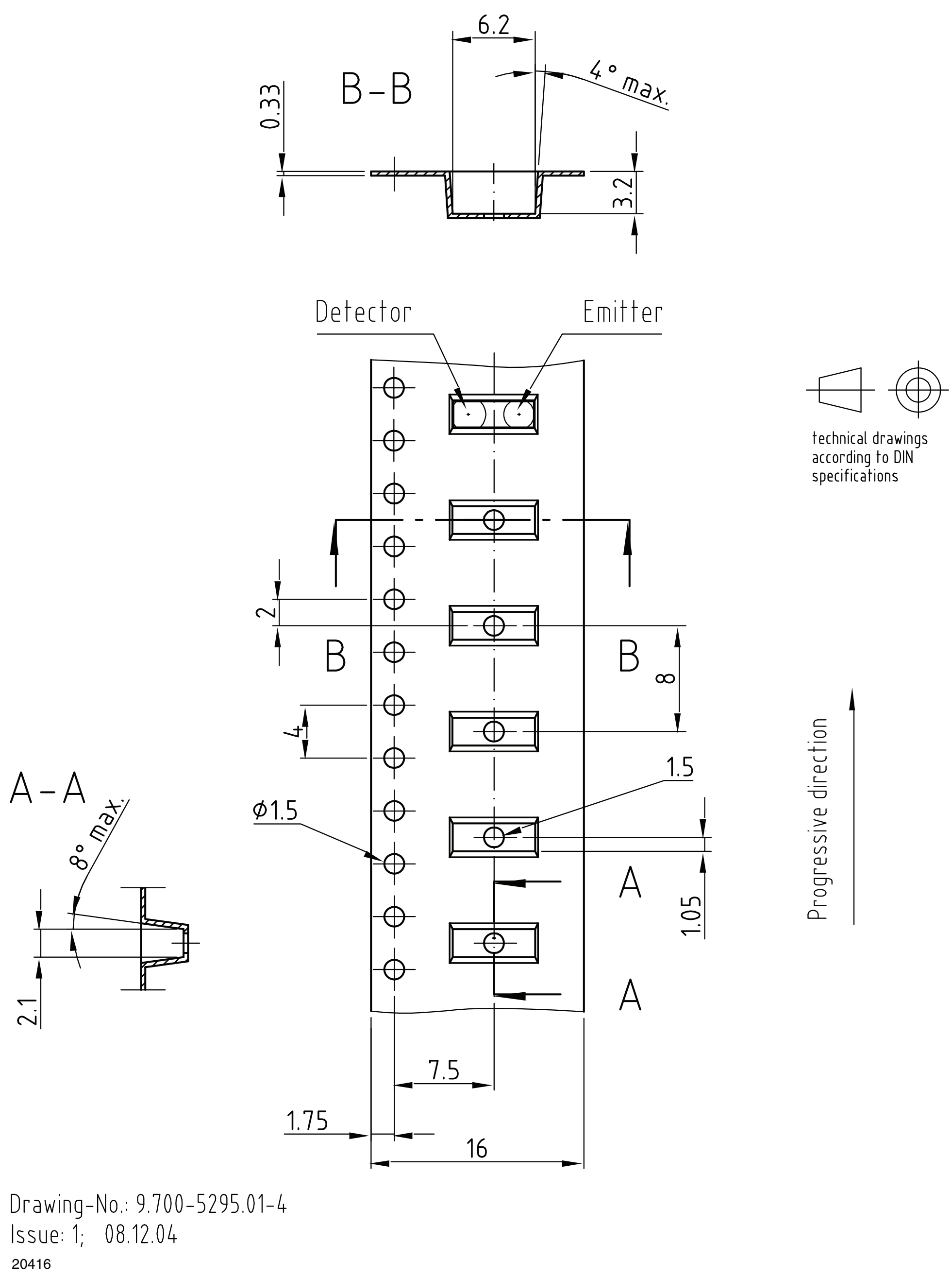
Sagging of carrier tape may cause some units to rotate and will result to pick-and-place problem. Do not allow carrier tape to sag as shown in picture below.



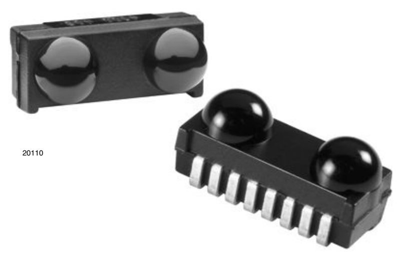
TAPE DIMENSIONS FOR TR1 AND TR3 in millimeters



TAPE DIMENSIONS FOR TT1 in millimeters



Infrared Transceiver Module (SIR, 115.2 kbit/s) for IrDA® Applications



MEMBER IrDA

LINKS TO ADDITIONAL RESOURCES

3D Models

DESCRIPTION

The TFDU4101 transceiver is an infrared transceiver module compliant to the latest IrDA® physical layer standard for fast infrared data communication, supporting IrDA speeds up to 115.2 kbit/s (SIR), and carrier based remote control modes. Integrated within the transceiver module are a photo pin diode, an infrared emitter (IRED), and a low-power control IC to provide a total front-end solution in a single package. This device covers the full IrDA range of more than 1 m using the internal intensity control. With one external current control resistor the current can be adjusted for shorter ranges saving operating current operating in IrDA low power mode. This Vishay SIR transceiver is using the lead frame technology.

The receiver output pulse duration is independent of the optical input pulse duration and recovers always a fixed pulse duration optimum for compatibility to standard Endecs and interfaces. TFDU4101 has a tristate output and is floating in shutdown mode with a weak pull-up.

FEATURES

- Operates from 2.4 V to 5.5 V within specification over full temperature range from -30 °C to +85 °C
- Split power supply, transmitter and receiver can be operated from two power supplies with relaxed requirements saving costs, US - patent no. 6,157,476
- Low power consumption (< 0.12 mA supply current in receive mode, no signal)
- Power shutdown mode (< 4 µA shutdown current in full temperature range, up to 85 °C, < 10 nA at 25 °C)
- Surface-mount package (L x W x H in mm): 9.7 × 4.7 × 4
- High efficiency emitter
- Low profile (universal) package capable of surface mount soldering to side and top view orientation
- Directly Interfaces with various super I/O and encoder / decoder devices
- Tri-state-receiver output, floating in shut down with a weak pull-up
- Qualified for lead (Pb)-free and Sn/Pb processing (MSL4)

Pb-free
e3
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

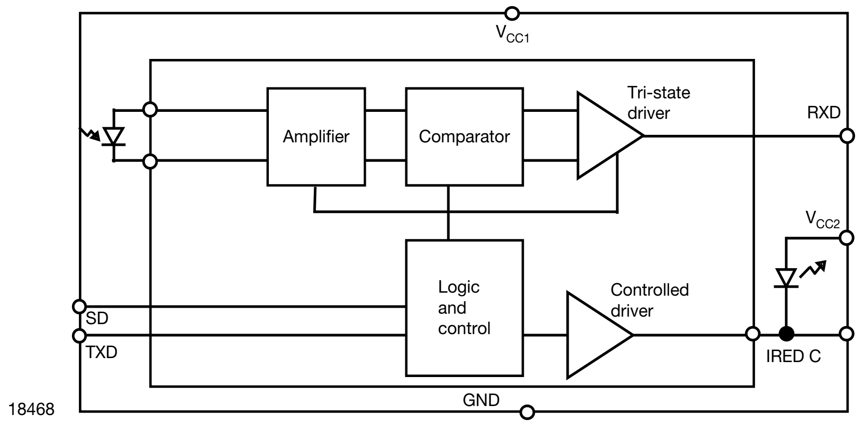
APPLICATIONS

- Printers, fax machines, photocopiers, screen projectors
- Internet TV boxes, video conferencing systems
- Medical data collection
- Diagnostic systems
- Notebook computers, desktop PCs, palmtop computers (Win CE, Palm PC), PDAs
- Internet TV boxes, video conferencing systems
- External infrared adapters (dongles)
- Data loggers
- GPS
- Kiosks, POS, point and pay devices
- Industrial applications

PRODUCT SUMMARY					
PART NUMBER	DATA RATE (kbit/s)	DIMENSIONS H x L x W (mm x mm x mm)	LINK DISTANCE (m)	OPERATING VOLTAGE (V)	IDLE SUPPLY CURRENT (mA)
TFDU4101	115.2	4 x 9.7 x 4.7	0 to ≥ 1	2.4 to 5.5	0.07

PARTS TABLE		
PART	DESCRIPTION	QTY/REEL
TFDU4101-TR3	Oriented in carrier tape for side view surface mounting	1000 pcs
TFDU4101-TT3	Oriented in carrier tape for top view surface mounting	1000 pcs

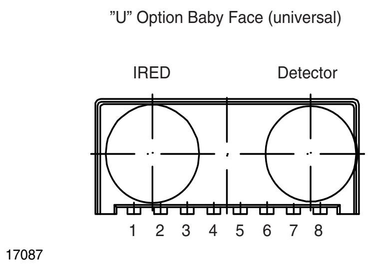
FUNCTIONAL BLOCK DIAGRAM



PIN DESCRIPTION				
PIN NUMBER	SYMBOL	DESCRIPTION	I/O	ACTIVE
1	V_{CC2} IRED anode	IRED anode to be externally connected to V_{CC2}. An external resistor is only necessary for controlling the IRED current when a current reduction below 300 mA is intended to operate in IrDA low power mode. This pin is allowed to be supplied from an uncontrolled power supply separated from the controlled V_{CC1} - supply.		
2	IRED cathode	IRED cathode, internally connected to driver transistor		
3	TXD	This Schmitt-Trigger input is used to transmit serial data when SD is low. An on-chip protection circuit disables the LED driver if the TXD pin is asserted for longer than 50 µs (max. 300 µs).	I	High
4	RXD	Received data output, push-pull CMOS driver output capable of driving standard CMOS or TTL loads. During transmission the RXD output is active (echo-on). No external pull-up or pull-down resistor is required. Floating with a weak pull-up of 500 kΩ (typ.) in shutdown mode.	O	Low
5	SD	Shutdown	I	High
6	V_{CC1}	Supply voltage		
7	NC	No internal connection	I	
8	GND	Ground		

PINOUT

TFDU4101
Weight 200 mg



ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage range, transceiver	-0.3 V < V_{CC2} < 6 V	V_{CC1}	-0.5	-	6	V
Supply voltage range, transmitter	-0.5 V < V_{CC1} < 6 V	V_{CC2}	-0.5	-	6	V
Voltage at RXD	-0.5 V < V_{CC1} < 6 V	V_{RXD}	-0.5	-	V_{CC1} + 0.5	V
Voltage at all inputs and outputs	V_{in} > V_{CC1} is allowed	V_{in}	-0.5	-	6	V
Input currents	For all pins, except IRED anode pin		-	-	10	mA
Output sinking current			-	-	25	mA
Power dissipation		P_D	-	-	250	mW
Junction temperature		T_J	-	-	125	°C
Ambient temperature range (operating)		T_{amb}	-30	-	+85	°C
Storage temperature range		T_{stg}	-30	-	+85	°C
Soldering temperature	See "Recommended Solder Profile"		-	-	260	°C
Average output current, pin 1		I_{IRED} (DC)	-	-	80	mA
Repetitive pulse output current, pin 1 to pin 2	< 90 µs, t_{on} < 20 %	I_{IRED} (RP)	-	-	400	mA
Thermal resistance junction-to-ambient	JESD51	R_{thJA}	-	300	-	K/W

Note

- Reference point pin, GND unless otherwise noted. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

EYE SAFETY INFORMATION

STANDARD	CLASSIFICATION
IEC/EN 60825-1 (2007-03), DIN EN 60825-1 (2008-05) "SAFETY OF LASER PRODUCTS - Part 1: equipment classification and requirements", simplified method	Class 1
IEC 62471 (2006), CIE S009 (2002) "Photobiological Safety of Lamps and Lamp Systems"	Exempt
DIRECTIVE 2006/25/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5th April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation) (19th individual directive within the meaning of article 16(1) of directive 89/391/EEC)	Exempt

Note

- Vishay transceivers operating inside the absolute maximum ratings are classified as eye safe according the above table

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	**TEST CONDITIONS/PINS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
TRANSCEIVER						
Supply voltage		V_{CC1}	2.4	-	5.5	V
Dynamic supply current	SD = low, E_e = 1 klx [(1)], T_{amb} = -25 °C to +85 °C V_{CC1} = V_{CC2} = 2.4 V to 5.5 V	I_{CC1}	40	90	130	μA
Dynamic supply current	SD = low, E_e = 1 klx [(1)], T_{amb} = 25 °C V_{CC1} = V_{CC2} = 2.4 V to 5.5 V	I_{CC1}	40	75	-	μA
Average dynamic supply current, transmitting	I_{IRED} = 300 mA, 25 % duty cycle	I_{CC}	-	0.65	2.5	mA
Shutdown supply current	SD = high, T = 25 °C, E_e = 0 klx no signal, no resistive load	I_{SD}	-	0.01	0.1	μA
	SD = high, T = 70 °C no signal, no resistive load	I_{SD}	-	-	1	μA
	SD = high, T = 85 °C no signal, no resistive load	I_{SD}	-	-	1	μA
Operating temperature range		T_A	-30	-	+85	°C
Output voltage low, RXD	C_{load} = 15 pF	V_{OL}	-0.5	-	0.15 x V_{CC1}	V
Output voltage high, RXD	I_{OH} = -500 μA, C_{Load} = 15 pF	V_{OH}	0.8 x V_{CC1}	-	V_{CC1} + 0.5	V
	I_{OH} = -250 μA, C_{Load} = 15 pF	V_{OH}	0.9 x V_{CC1}	-	V_{CC1} + 0.5	V
RXD to V_{CC1} impedance		R_{RXD}	400	500	600	kΩ
Input voltage low (TXD, SD)	SD = high	V_{IL}	-0.5	-	0.5	V
Input voltage high (TXD, SD)		V_{IH}	V_{CC1} - 0.5	-	6	V
Input leakage current (TXD, SD)	V_{in} = 0.9 x V_{CC1}	I_{ICH}	-2	-	+2	μA
Controlled pull down current 0 < V_{in} < 0.15 V_{CC1} V_{in} > 0.7 V_{CC1}	SD, TXD = "0" or "1"	I_{IrTX}	-1	0	+150 1	μA μA
Input capacitance (TXD, SD)		C_I	-	-	5	pF

Notes

- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

(1) Standard illuminant A

(2) The typical threshold level is 0.5 x V_{CC1}. It is recommended to use the specified min./max. values to avoid increased operating current

OPTOELECTRONIC CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
RECEIVER						
Minimum irradiance E_e in angular range (2) SIR mode	9.6 kbit/s to 115.2 kbit/s λ = 850 nm to 900 nm; α = 0°, 15°	$E_{e,\ min.}$	4 (0.4)	20 (2)	35 (1) (3.5)	mW/m² (µW/cm²)
Maximum irradiance E_e in angular range (3)	λ = 850 nm to 900 nm	$E_{e,\ max.}$	5 (500)	-	-	kW/m² (mW/cm²)
Rise time of output signal	10 % to 90 %, C_L = 15 pF	$t_{r\ (RXD)}$	20	-	100	ns
Fall time of output signal	90 % to 10 %, C_L = 15 pF	$t_{f\ (RXD)}$	20	-	100	ns
RXD pulse width	Input pulse length > 1.2 µs	t_{PW}	1.65	2.2	3	µs
Leading edge jitter	Input irradiance = 100 mW/m², ≤ 115.2 kbit/s		-	-	250	ns
Standby/shutdown delay, receiver startup time	After shutdown active or power-on		-	100	500	µs
Latency		t_L	-	100	150	µs
TRANSMITTER						
IRED operating current, switched current limiter	No external resistor for current limitation (4)	I_D	250	300	350	mA
Forward voltage of built-in IRED	I_f = 300 mA	V_f	1.4	1.8	1.9	V
Output leakage IRED current		I_{IRED}	-1	-	1	µA
Output radiant intensity	α = 0°, 15° TXD = high, SD = low	I_e	48	65	150	mW/sr
Output radiant intensity	V_{CC1} = 5 V, α = 0°, 15° TXD = low or SD = high (receiver is inactive as long as SD = high)	I_e	-	-	0.04	mW/sr
Output radiant intensity, angle of half intensity		α	-	± 24	-	deg
Peak - emission wavelength (5)		λ_p	880	-	900	nm
Spectral bandwidth		Δλ	-	45	-	nm
Optical rise time, optical fall time		t_{ropt}, t_{fopt}	10	-	300	ns
Optical output pulse duration	Input pulse width 1.6 µs < t_{TXD} < 20 µs	t_{opt}	t_{TXD} - 0.15	-	t_{TXD} + 0.15	µs
Optical output pulse duration	Input pulse width t_{TXD} ≥ 20 µs	t_{opt}	-	20	300	µs
Optical overshoot			-	-	25	%

Notes

- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

(1) IrDA specification is 40 mW/m². Specification takes a window loss of 10 % into account

(2) IrDA sensitivity definition: minimum irradiance E_e in angular range, power per unit area. The receiver must meet the BER specification while the source is operating at the minimum intensity in angular range into the minimum half-angular range at the maximum link length

(3) Maximum irradiance E_e in angular range, power per unit area. The optical delivered to the detector by a source operating at the maximum intensity in angular range at minimum link length must not cause receiver overdrive distortion and possible ralated link errors. If placed at the active output interface reference plane of the transmitter, the receiver must meet its bit error ratio (BER) specification

(4) Using an external current limiting resistor is allowed and recommended to reduce IRED intensity and operating current when current reduction is intended to operate at the IrDA low power conditions. E.g. for V_{CC2} = 3.3 V a current limiting resistor of R_S = 56 Ω will allow a power minimized operation at IrDA low power conditions

(5) Due to this wavelength restriction compared to the IrDA spec of 850 nm to 900 nm the transmitter is able to operate as source for the standard remote control applications with codes as e.g. Phillips RC5/RC6® or RECS 80

For more definitions see the document "Symbols and Terminology" on the Vishay website.

RECOMMENDED CIRCUIT DIAGRAM

Operated with a clean low impedance power supply the TFDU4101 needs no additional external components. However, depending on the entire system design and board layout, additional components may be required (see figure 1). That is especially the case when separate power supplies are used for bench tests. When using compact wiring and regulated supplies as e. g. in phone applications in most cases no external components are necessary.

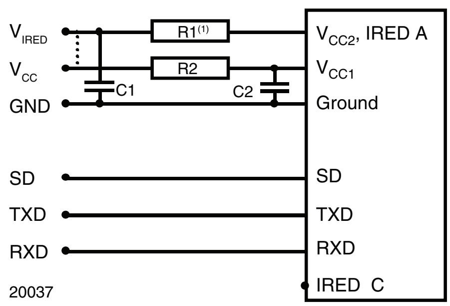


Fig. 1 - Recommended Test Circuit

Note

(1) R1 is optional when reduced intensity is used

The capacitor C1 is buffering the supply voltage and eliminates the inductance of the power supply line. This one should be a Tantalum or other fast capacitor to guarantee the fast rise time of the IRED current. The resistor R1 is the current limiting resistor, which may be used to reduce the operating current to levels below the specified controlled values for saving battery power.

Vishay's transceivers integrate a sensitive receiver and a built-in power driver. The combination of both needs a careful circuit board layout. The use of thin, long, resistive and inductive wiring should be avoided. The shutdown input must be grounded for normal operation, also when the shutdown function is not used.

The inputs (TXD, SD) and the output RXD should be directly connected (DC-coupled) to the I/O circuit. The capacitor C2 combined with the resistor R2 is the low pass filter for smoothing the supply voltage. R2, C1 and C2 are optional and dependent on the quality of the supply voltages V_{CC1} and injected noise. An unstable power supply with dropping voltage during transmission may reduce the sensitivity (and transmission range) of the transceiver.

The placement of these parts is critical. It is strongly recommended to position C2 as close as possible to the transceiver power supply pins.

When extended wiring is used (bench tests!) the inductance of the power supply can cause dynamically a voltage drop at V_{CC2}. Often some power supplies are not able to follow the fast current rise time. In that case another 4.7 µF (type, see table under C1) at V_{CC2} will be helpful.

Under extreme EMI conditions as placing an RF-transmitter antenna on top of the transceiver, we recommend to protect all inputs by a low-pass filter, as a minimum a 12 pF capacitor, especially at the RXD port. The transceiver itself withstands EMI at GSM frequencies above 500 V/m. When interference is observed, the wiring to the inputs picks it up. It is verified by DPI measurements that as long as the interfering RF - voltage is below the logic threshold levels of the inputs and equivalent levels at the outputs no interferences are expected.

One should keep in mind that basic RF-design rules for circuit design should be taken into account. Especially longer signal lines should not be used without termination. See e.g. “The Art of Electronics” Paul Horowitz, Winfield Hill, 1989, Cambridge University Press, ISBN: 0521370957.

TABLE 1 - RECOMMENDED TESTS AND APPLICATION CIRCUIT COMPONENTS

COMPONENT	RECOMMENDED VALUE	VISHAY PART NUMBER
C1	4.7 µF, 16 V	293D 475X9 016B
C2	0.1 µF, ceramic	VJ 1206 Y 104 J XXMT
R1	Depends on current to be adjusted, e. g. with V_{CC2} = 3.3 V 56 Ω is an option for minimum low power operation	
R2	47 Ω, 0.125 W	CRCW-1206-47R0-F-RT1

Figure 2 shows an example of a typical application with a separate supply voltage V_S and using the transceiver with the IRED anode connected to the unregulated battery V_{batt}. This method reduces the peak load of the regulated power supply and saves therefore costs. Alternatively all supplies can also be tied to only one voltage source. R1 and C1 are not used in this case and are depending on the circuit design in most cases not necessary.

In Fig. 2 an option is shown to operate the transmitter at two different power levels to switch for long range to low power mode for e.g. saving power for IrDA application but use the full range specification for remote control. The additional components are marked in the figure.

For operating at RS232 ports we recommend to use an encoder / decoder-module.

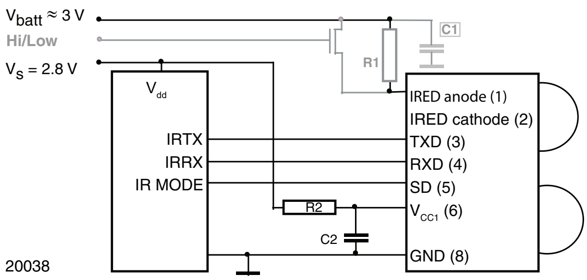


Fig. 2 - Typical Application Circuit
Grey: Optional for High/Low Switching

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 2 - TRUTH TABLE

INPUTS			OUTPUTS		REMARK
SD	**TXD**	**OPTICAL INPUT IRRADIANCE mW/m^2**	**RXD**	**TRANSMITTER**	**OPERATION**
High > 1 ms	x	x	Weakly pulled (500 kΩ) to V_{CC1}	0	Shutdown
Low	High < 50 µs	x	Low active	I_e	Transmitting
	High > 50 µs	x	High inactive	0	Protection is active
	Low	< 4	High inactive	0	Ignoring low signals below the IrDA defined threshold for noise immunity
	Low	> min. irradiance E_e < max. irradiance E_e	Low (active)	0	Response to an IrDA compliant optical input signal
	Low	> max. irradiance E_e	Undefined	0	Overload conditions can cause unexpected outputs

RECOMMENDED SOLDER PROFILES

Solder Profile for Sn/Pb Soldering

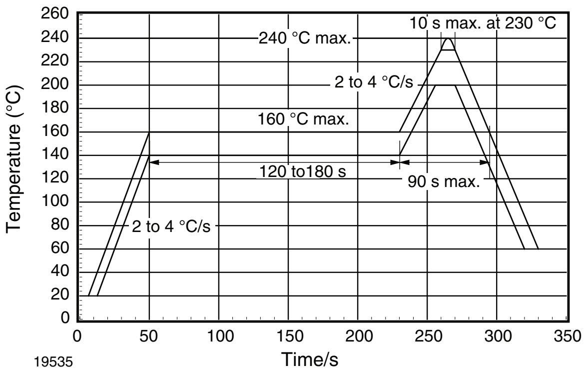


Fig. 3 - Recommended Solder Profile for Sn/Pb Soldering

Lead (Pb)-free, Recommended Solder Profile

The TFDU4101 is a lead (Pb)-free transceiver and qualified for lead (Pb)-free processing. For lead (Pb)-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 5 and 6 are Vishay's recommended profiles for use with the TFDU4101 transceivers. For more details please refer to the application note "SMD Assembly Instructions". 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.

Wave Soldering

For TFDUxxxx, TFBSxxxx, and TFBRxxxx transceiver devices wave soldering is not recommended.

Manual Soldering

Manual soldering is the standard method for lab use. However, for a production process it cannot be recommended because the risk of damage is highly dependent on the experience of the operator. Nevertheless, we added a chapter to the above mentioned application note, describing manual soldering and desoldering.

Storage

The storage and drying processes for all Vishay transceivers (TFDUxxxx, TFBSxxxx, and TFBRxxxx) are equivalent to MSL4.

The data for the drying procedure is given on labels on the packing and also in the application note "Taping, Labeling, Storage and Packing".

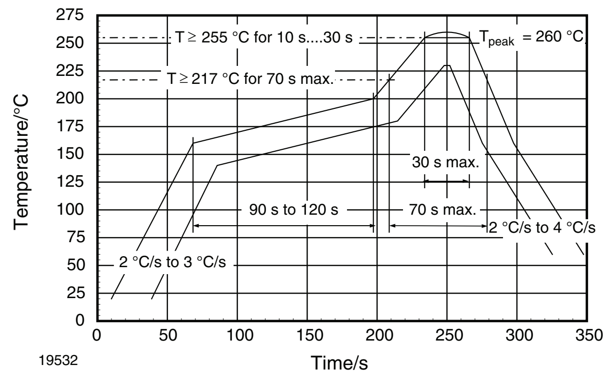


Fig. 4 - Solder Profile, RSS Recommendation

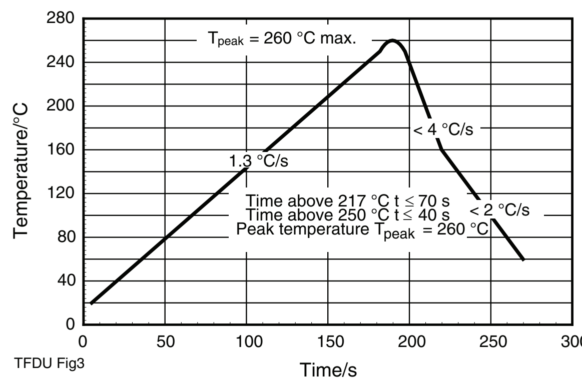


Fig. 5 - RTS Recommendation

PACKAGE DIMENSIONS in millimeters

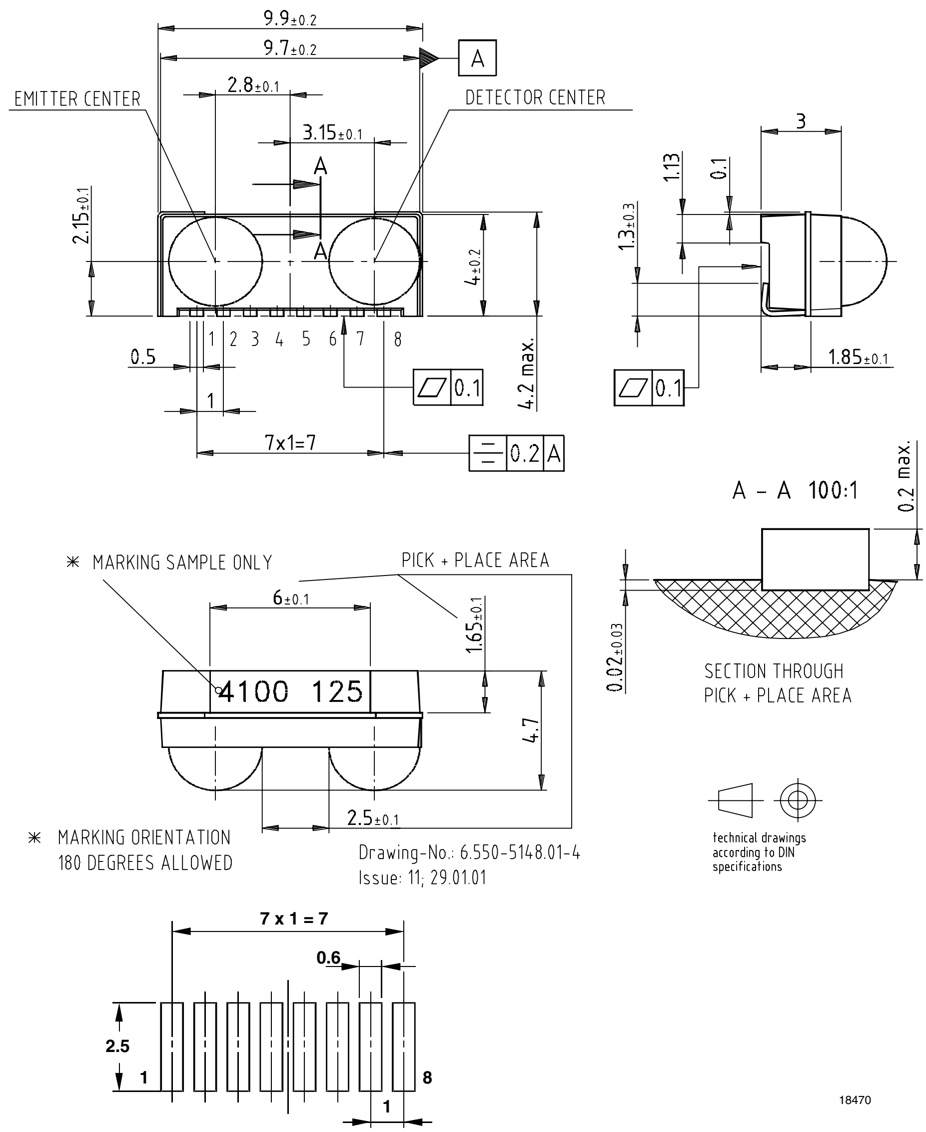


Fig. 6 - Package Drawing TFDU4101. Tolerance ± 0.2 mm if not otherwise mentioned

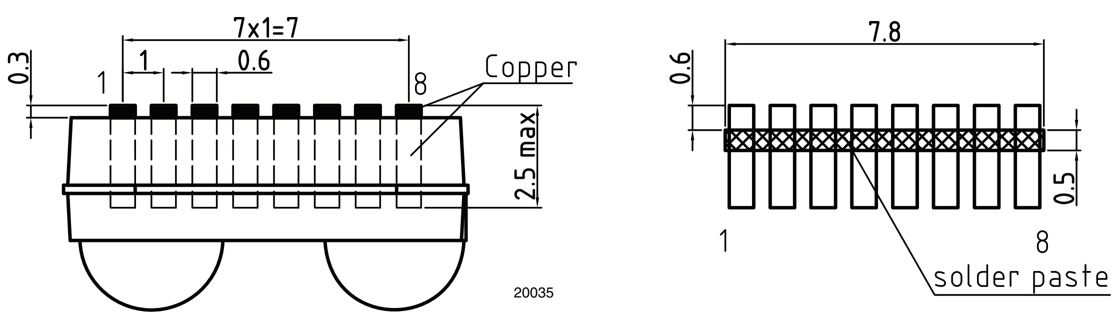


Fig. 7 - Recommended Footprint for Side View Applications and Solderpaste Mask

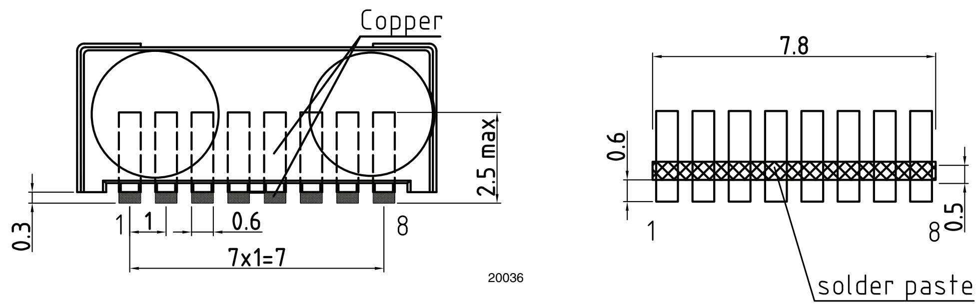
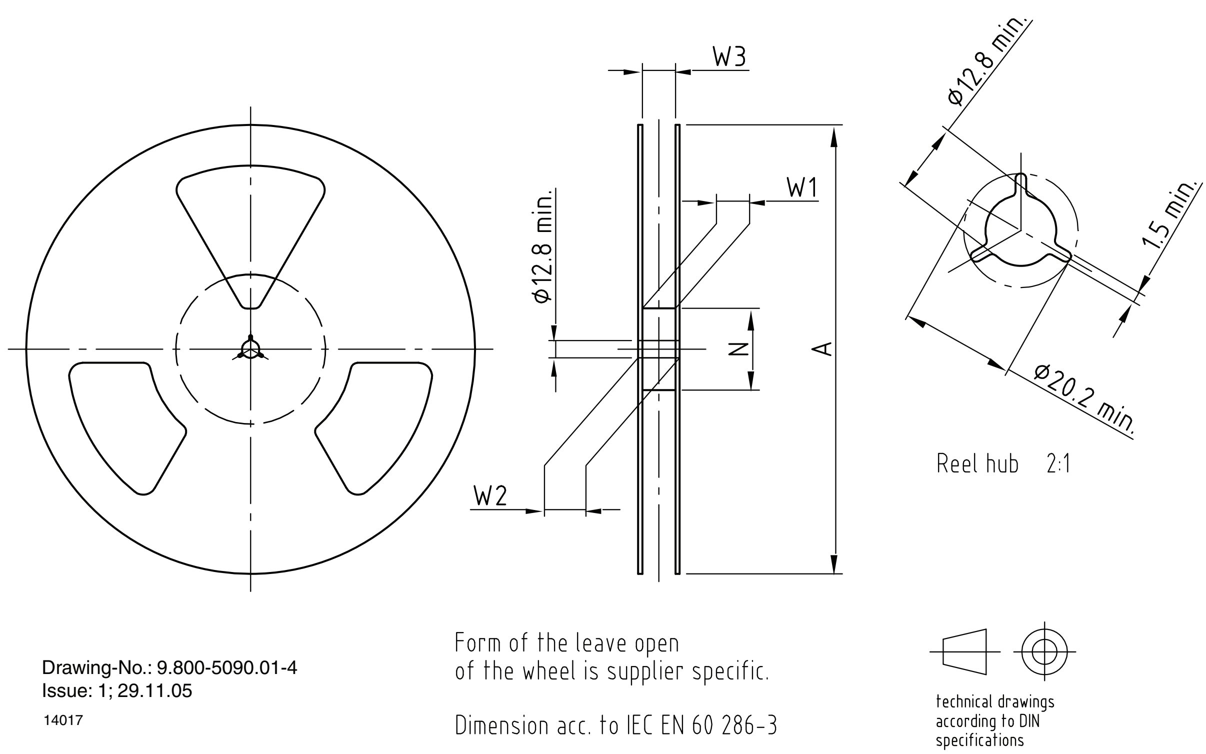


Fig. 8 - Recommended Footprint for Top View Applications and Solderpaste Mask

REEL DIMENSIONS in millimeters



TAPE WIDTH (mm)	A MAX. (mm)	N (mm)	W_1 MIN. (mm)	W_2 MAX. (mm)	W_3 MIN. (mm)	W_3 MAX. (mm)
24	330	60	24.4	30.4	23.9	27.4

TAPE DIMENSIONS FOR TT3 in millimeters

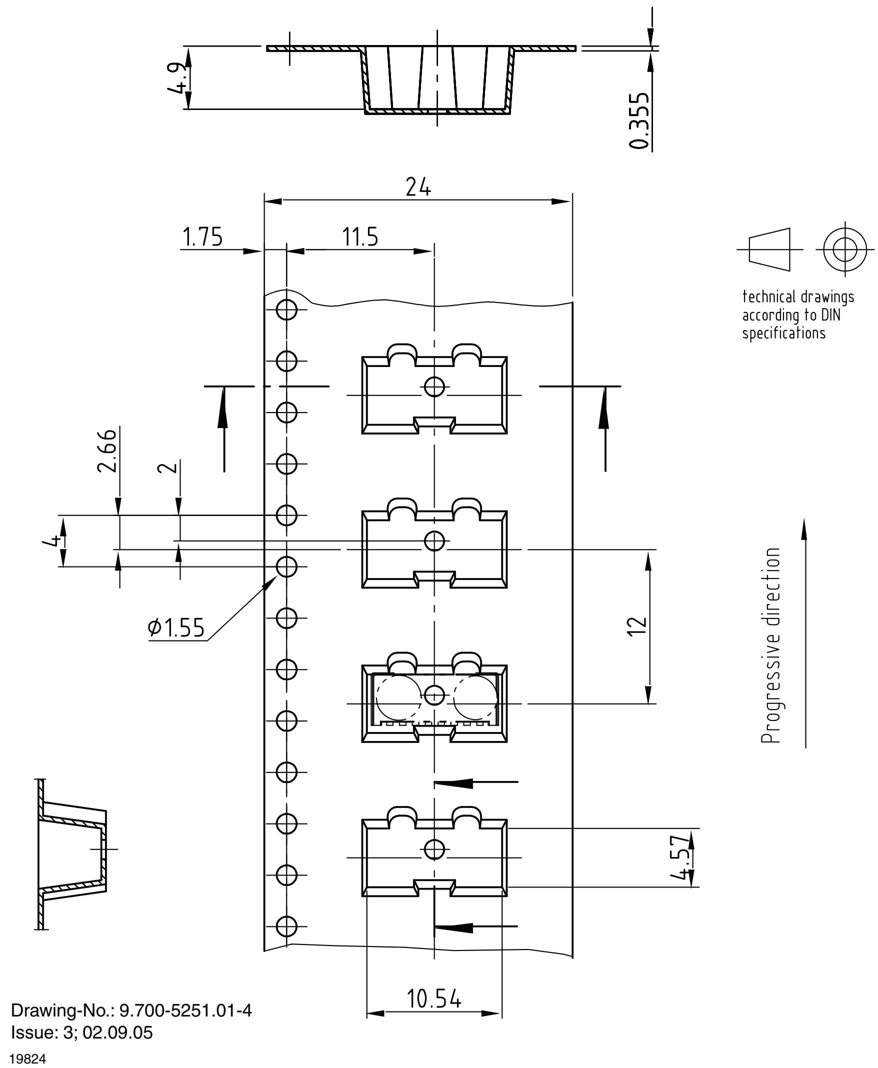
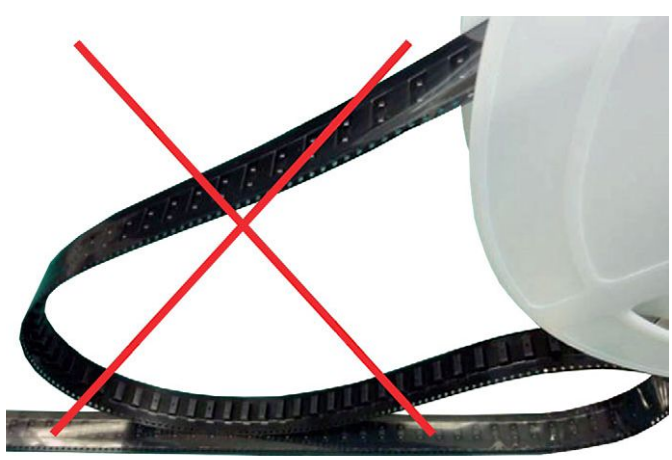


Fig. 9 - Tape Drawing, TFDU4101 for Top View Mounting, Tolerance ± 0.1 mm

HANDLING PRECAUTION

Sagging of carrier tape may cause some units to rotate and will result to pick-and-place problem. Do not allow carrier tape to sag as shown in picture below.



TAPE DIMENSIONS FOR TR3 in millimeters

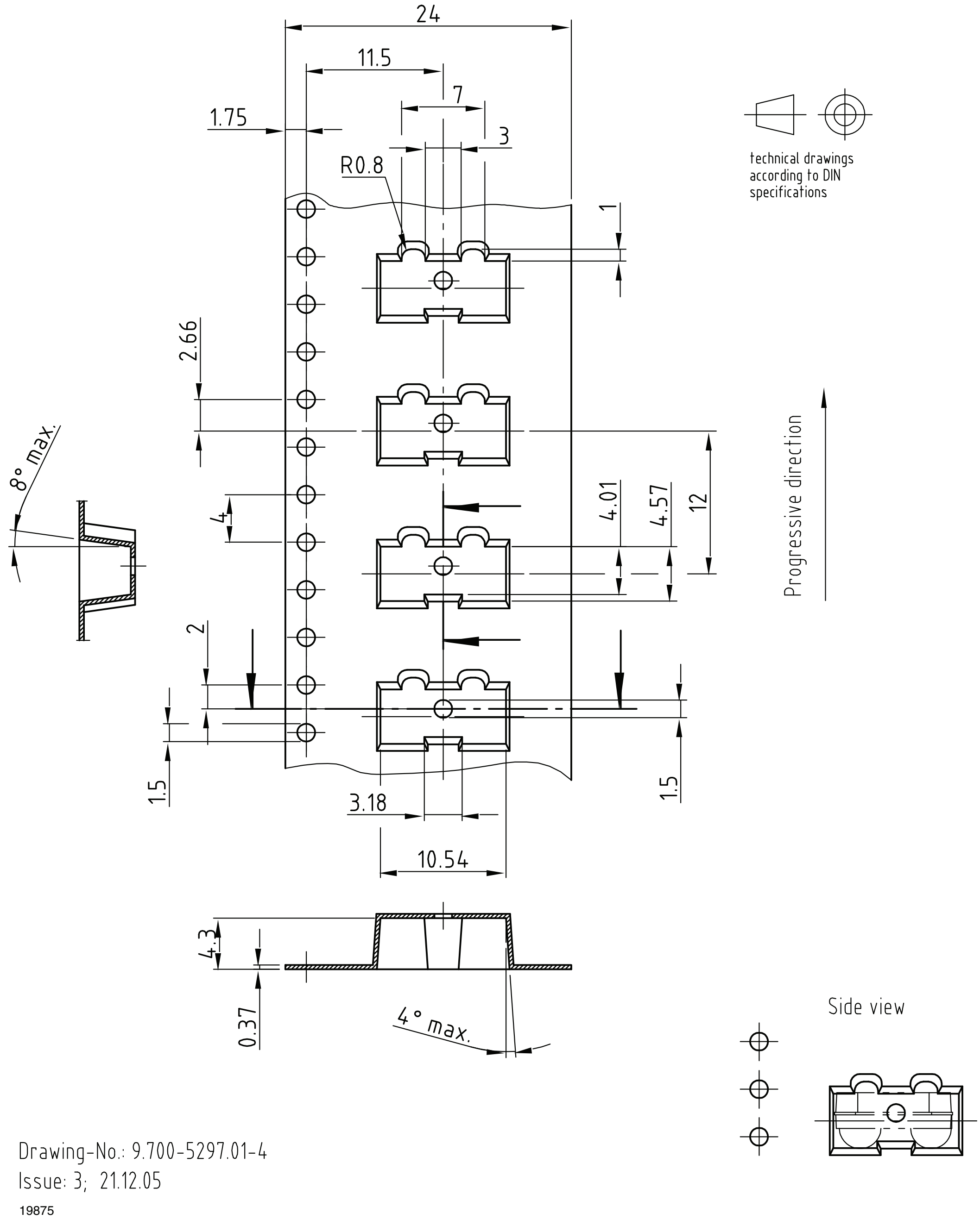
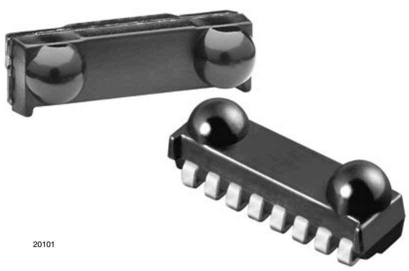


Fig. 10 - Tape Drawing, TFDU4101 for Side View Mounting, Tolerance ± 0.1 mm

Infrared Transceiver Module (SIR, 115.2 kbit/s) for IrDA® Applications



MEMBER IrDA Infrared Data Association

LINKS TO ADDITIONAL RESOURCES

3D Models

DESCRIPTION

The TFDU4301 is a low profile (2.5 mm) infrared transceiver module. It is compliant to the latest IrDA® physical layer standard for fast infrared data communication, supporting IrDA speeds up to 115.2 kbit/s (SIR) and carrier based remote control. The transceiver module consists of a PIN photodiode, an infrared emitter (IRED), and a low-power control IC to provide a total front-end solution in a single package.

This device covers an extended IrDA low power range of close to 1 m. With an external current control resistor the current can be adjusted for shorter ranges.

The RXD output pulse width is independent of the optical input pulse width and stays always at a fixed pulse width thus making the device optimum for standard endecs. TFDU4301 has a tri-state output and is floating in shut-down mode with a weak pull-up.

APPLICATIONS

- Ideal for battery operated applications
- Telecommunication products (cellular phones, pagers)
- Digital still and video cameras
- Printers, fax machines, photocopiers, screen projectors
- Medical and industrial data collection
- Diagnostic systems
- Notebook computers, desktop PCs, palmtop computers (Win CE, Palm PC), PDAs
- Internet TV boxes, video conferencing systems
- External infrared adapters (dongles)
- Data loggers
- GPS
- Kiosks, POS, point and pay devices including IrFM - applications

FEATURES

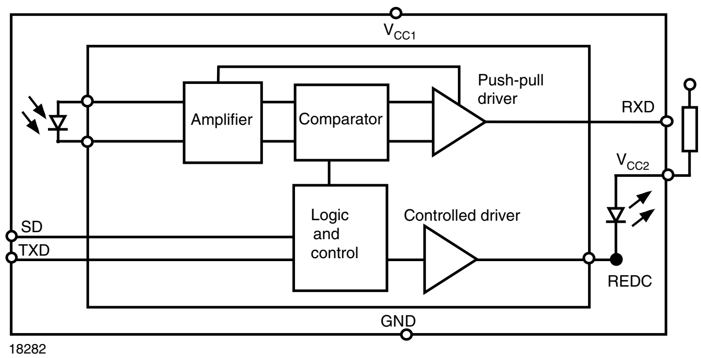
- Compliant to the latest IrDA physical layer specification (9.6 kbit/s to 115.2 kbit/s) and TV remote control, bi-directional operation included
- Operates from 2.4 V to 5.5 V within specification over full temperature range from -30 °C to +85 °C
- Split power supply, transmitter and receiver can be operated from two power supplies with relaxed requirements saving costs, US patent no. 6.157.476
- Extended IrDA low power range to about 70 cm
- Typical remote control range 12 m
- Low power consumption (< typ. supply current 70 μA)
- Power shutdown mode (< 1 μA shutdown current in full temperature range, up to 85 °C)
- Low profile (2.5 mm) (L x W x H in mm): 8.5 × 2.5 × 3.1
- Surface-mount package
- High efficiency emitter
- Low profile (universal) package capable of surface-mount soldering to side and top view orientation
- Directly interfaces with various super I/O and encoder / decoder devices
- Tri-state-receiver output, floating in shut down with a weak pull-up
- Compliant with IrDA background light specification
- EMI immunity in GSM bands > 300 V/m verified
- Qualified for lead (Pb)-free and Sn/Pb processing (MSL4)

Pb-free
e3
RoHS COMPLIANT
HALOGEN FREE
GREEN (5-2008)

PRODUCT SUMMARY					
PART NUMBER	DATA RATE (kbit/s)	DIMENSIONS H x L x W (mm x mm x mm)	LINK DISTANCE (m)	OPERATING VOLTAGE (V)	IDLE SUPPLY CURRENT (mA)
TFDU4301	115.2	3.1 x 8.5 x 2.5	0 to ≥ 0.7	2.4 to 5.5	0.07

PARTS TABLE		
PART	DESCRIPTION	QTY/REEL
TFDU4301-TR1	Oriented in carrier tape for side view surface mounting	750 pcs
TFDU4301-TR3	Oriented in carrier tape for side view surface mounting	2500 pcs
TFDU4301-TT1	Oriented in carrier tape for top view surface mounting	750 pcs
TFDU4301-TT3	Oriented in carrier tape for top view surface mounting	2500 pcs

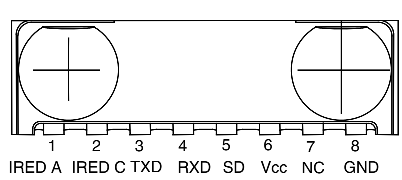
FUNCTIONAL BLOCK DIAGRAM



PIN DESCRIPTION				
PIN NUMBER	FUNCTION	DESCRIPTION	I/O	ACTIVE
1	V_{CC2} IRED anode	Connect IRED anode directly to the power supply (V_{CC2}). IRED 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	IRED cathode	IRED cathode, internally connected to the driver transistor		
3	TXD	This Schmitt-Trigger input is used to transmit serial data when SD is low. An on-chip protection circuit disables the LED driver if the TXD pin is asserted for longer than 100 µs. The input threshold voltage adapts to and follows the logic voltage swing defined by the applied supply voltage	I	High
4	RXD	Received data output, push-pull CMOS driver output capable of driving standard CMOS or TTL loads. During transmission the RXD output is active and mirrors the transmit signal. No external pull-up or pull-down resistor is required. Floating with a weak pull-up of 500 kΩ (typ.) in shutdown mode. The voltage swing is defined by the applied supply voltage	O	Low
5	SD	Shutdown. The input threshold voltage adapts to and follows the logic voltage swing defined by the applied supply voltage	I	High
6	V_{CC1}	Supply voltage		
7	NC	Not connected	I	
8	GND	Ground		

PINOUT

TFDU4301
weight 75 mg



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).

ABSOLUTE MAXIMUM RATINGS

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage range, transceiver	-0.3 V < V_{CC2} < 6 V	V_{CC1}	-0.5	-	+6	V
Supply voltage range, transmitter	-0.5 V < V_{CC1} < 6 V	V_{CC2}	-0.5	-	+6	V
RXD output voltage	-0.5 V < V_{CC1} < 6 V	V_{RXD}	-0.5	-	V_{CC1} + 0.5	V
Voltage at all inputs	Note: $V_{in} \geq V_{CC1}$ is allowed	V_{IN}	-0.5	-	+6	V
Input current	For all pins, except IRED anode pin		-	-	10	mA
Output sinking current			-	-	25	mA
Power dissipation		P_D	-	-	250	mW
Junction temperature		T_J	-	-	125	°C
Ambient temperature range (operating)		T_{amb}	-30	-	+85	°C
Storage temperature range		T_{stg}	-40	-	+100	°C
Soldering temperature	See recommended solder profile		-	-	260	°C
Average output current, pin 1		$I_{IRED(DC)}$	-	-	85	mA
Repetitive pulsed output current, pin 1 to pin 2	t < 90 μs, t_{on} < 20 %	$I_{IRED(RP)}$	-	-	430	mA
ESD protection		V_{ESD}	1	-	-	kV
Latchup			|± 100|	-	-	mA
Thermal resistance junction-to-ambient	JESD51	R_{thJA}	-	300	-	K/W

Note

- Reference point ground (pin 8) unless otherwise noted.
  Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
  We apologize to use sometimes in our documentation the abbreviation LED and the word light emitting diode instead of infrared emitting diode (IRED) for IR-emitters. That is by definition wrong; we are here following just a bad trend.
  Typical values are for design aid only, not guaranteed nor subject to production testing and may vary with time

EYE SAFETY INFORMATION

STANDARD	CLASSIFICATION
IEC/EN 60825-1 (2007-03), DIN EN 60825-1 (2008-05) "SAFETY OF LASER PRODUCTS - Part 1: equipment classification and requirements", simplified method	Class 1
IEC 62471 (2006), CIE S009 (2002) "Photobiological Safety of Lamps and Lamp Systems"	Exempt
DIRECTIVE 2006/25/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5th April 2006 on the minimum health and safety requirements regarding the exposure of workers to risks arising from physical agents (artificial optical radiation) (19th individual directive within the meaning of article 16(1) of directive 89/391/EEC)	Exempt

Note

- Vishay transceivers operating inside the absolute maximum ratings are classified as eye safe according the above table

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)

PARAMETER	TEST CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
TRANSCEIVER						
Supply voltage		V_{CC1}	2.4	-	5.5	V
Operating temperature range		T_{amb}	-30	-	+85	°C
Data rates			9.6	-	115.2	kbit/s
Idle supply current at V_{CC1} (receive mode, no signal)	SD = low, T_{amb} = -25 °C to +85 °C independent of ambient light, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V	I_{CC1}	40	70	150	μA
	SD = low, T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V	I_{CC1}	40	70	100	μA
Average dynamic supply current, transmitting	I_{IRED} = 300 mA, 20 % duty cycle	I_{CC1}	-	0.6	2	mA
Standby (SD) (1) supply current	SD = high, T_{amb} = -25 °C to +85 °C independent of ambient light	I_{SD}	-	0.01	1	μA
RXD to V_{CC1} impedance		R_{RXD}	400	500	600	kΩ
Input voltage low (TXD, SD)	SD = high	V_{ILo}	-0.3	-	0.4	V

ELECTRICAL CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
TRANSCEIVER						
Input voltage high (SD)	For compliance with ISD spec.	V_{IHi}	V_{CC1} - 0.3	-	6	V
Input voltage high (TXD)		V_{IHi}	V_{CC1} - 0.5	-	6	V
Timing logic decision level			-	0.5 x V_{CC1}	-	
Input leakage current low	$V_{ILo} \leq 0.3$ V	I_{ILo}	-	0.01	10	µA
Input leakage current high	$V_{IHi} \geq V_{CC1}$ - 0.3 V	I_{IHi}	-	0.01	10	µA
Input capacitance (TXD, SD)		C_{IN}	-	-	5	pF
Output voltage low, RXD	C_{load} = 8 pF, $I_{OLo} \leq$ |+500 µA|	V_{OLo}	-	-	0.4	V
Output voltage high, RXD	I_{OH} = -200 µA	V_{OHi}	0.8 x V_{CC1}	-	V_{CC1}	V

Notes

- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

(1) SD mode becomes active when SD is set high for more than 0.2 µs. In SD mode the detector is disabled and the output disconnected

OPTOELECTRONIC CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
RECEIVER						
Minimum irradiance E_e in angular range (2)	9.6 kbit/s to 115.2 kbit/s, λ = 850 nm to 900 nm; α = 0°, 15°	E_e	-	40 (4)	80 (8)	mW/m² (µW/cm²)
Maximum irradiance E_e In Angular Range (3)	λ = 850 nm to 900 nm	E_e	-	5 (500)	-	kW/m² (mW/cm²)
Maximum no detection irradiance (1)	λ = 850 nm to 900 nm, t_r, t_f < 40 ns, t_{po} = 1.6 µs at f = 115 kHz, no output signal allowed	E_e	4 (0.4)	-	-	mW/m² (µW/cm²)
Rise time of output signal	10 % to 90 %, C_L = 8 pF	$t_{r(RXD)}$	10	30	80	ns
Fall time of output signal	90 % to 10 %, C_L = 8 pF	$t_{f(RXD)}$	10	30	80	ns
RXD pulse width of output signal	Input pulse length > 1.2 µs	t_{PW}	1.7	2.2	3	µs
Stochastic jitter, leading edge	Input irradiance = 100 mW/m², ≤ 115.2 kbit/s		-	-	350	ns
Standby/shutdown delay, receiver startup time	After shutdown active or power-on		-	100	500	µs
Latency		t_L	-	50	150	µs
TRANSMITTER						
IRED operating current limitation	No external resistor for current limitation (4)	I_D	200	300	430	mA
Forward voltage of built-in IRED	I_f = 300 mA	V_f	1.4	1.8	1.9	V
Output leakage IRED current	TXD = 0 V, 0 < V_{CC1} < 5.5 V	I_{IRED}	-1	0.01	1	µA
Output radiant intensity	α = 0°, 15°, TXD = high, SD = low	I_e	30	65	150	mW/sr
	V_{CC1} = 5 V, α = 0°, 15°, TXD = low or SD = high (receiver is inactive as long as SD = high)	I_e	-	-	0.04	mW/sr
Output radiant intensity, angle of half intensity		α	-	± 24	-	°
Peak - emission wavelength (5)		λ_p	880	-	900	nm
Spectral bandwidth		$\Delta\lambda$	-	45	-	nm

OPTOELECTRONIC CHARACTERISTICS (T_{amb} = 25 °C, V_{CC1} = V_{CC2} = 2.4 V to 5.5 V unless otherwise noted)						
PARAMETER	**TEST CONDITIONS**	**SYMBOL**	**MIN.**	**TYP.**	**MAX.**	**UNIT**
TRANSMITTER						
Optical rise time, fall time		t_{ropt}, t_{fopt}	10	50	300	ns
Optical output pulse duration	Input pulse width 1.6 < t_{TXD} < 23 µs	t_{opt}	t_{TXD} - 0.15		t_{TXD} + 0.15	µs
	Input pulse width $t_{TXD} \geq$ 23 µs	t_{opt}	23	50	100	µs
Optical overshoot					25	%

Notes

- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

(1) Equivalent to IrDA background light and electromagnetic field test: fluorescent lighting immunity

(2) IrDA sensitivity definition: minimum irradiance E_e in angular range, power per unit area. The receiver must meet the BER specification while the source is operating at the minimum intensity in angular range into the minimum half-angular range at the maximum link length

(3) Maximum irradiance E_e in angular range, power per unit area. The optical delivered to the detector by a source operating at the maximum intensity in angular range at minimum link length must not cause receiver overdrive distortion and possible ralated link errors. If placed at the active output interface reference plane of the transmitter, the receiver must meet its bit error ratio (BER). For more definitions see the document "Symbols and Terminology" on the Vishay website

(4) Using an external current limiting resistor is allowed and recommended to reduce IRED intensity and operating current when current reduction is intended to operate at the IrDA low power conditions. E.g. for V_{CC2} = 3.3 V a current limiting resistor of R_S = 56 Ω will allow a power minimized operation at IrDA low power conditions

(5) Due to this wavelength restriction compared to the IrDA spec of 850 nm to 900 nm the transmitter is able to operate as source for the standard remote control applications with codes as e.g. Phillips RC5/RC6® or RECS 80

RECOMMENDED CIRCUIT DIAGRAM

Operated with a clean low impedance power supply the TFDU4301 needs no additional external components. However, depending on the entire system design and board layout, additional components may be required (see Fig. 1).

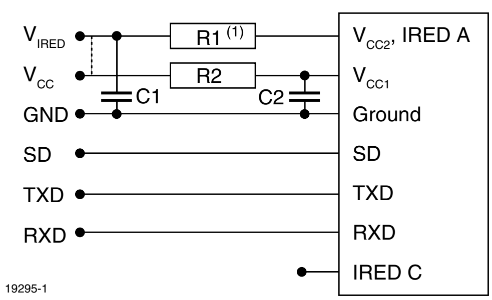


Fig. 1 - Recommended Application Circuit

Note

(1) R1 is optional when reduced intensity is used

The capacitor C1 is buffering the supply voltage and eliminates the inductance of the power supply line. This one should be a tantalum or other fast capacitor to guarantee the fast rise time of the IRED current. The resistor R1 is the current limiting resistor, which may be used to reduce the operating current to levels below the specified controlled values for saving battery power.

Vishay's transceivers integrate a sensitive receiver and a built-in power driver. The combination of both needs a careful circuit board layout. The use of thin, long, resistive and inductive wiring should be avoided. The shutdown input must be grounded for normal operation, also when the shutdown function is not used.

TABLE 1 - RECOMMENDED APPLICATION CIRCUIT COMPONENTS

COMPONENT	RECOMMENDED VALUE	VISHAY PART NUMBER
C1	4.7 µF, 16 V	293D 475X9 016B
C2	0.1 µF, ceramic	VJ 1206 Y 104 J XXMT
R1	Depends on current to be adjusted	
R2	47 Ω, 0.125 W	CRCW-1206-47R0-F-RT1

The inputs (TXD, SD) and the output RXD should be directly connected (DC - coupled) to the I/O circuit. The capacitor C2 combined with the resistor R2 is the low pass filter for smoothing the supply voltage. R2, C1 and C2 are optional and dependent on the quality of the supply voltages V_{CC}1 and injected noise. An unstable power supply with dropping voltage during transmision may reduce the sensitivity (and transmission range) of the transceiver.

The placement of these parts is critical. It is strongly recommended to position C2 as close as possible to the transceiver pins.

When extended wiring is used as in bench tests the inductance of the power supply can cause dynamically a voltage drop at V_{CC2}. Often some power supplies are not able to follow the fast current rise time. In that case another 4.7 µF (type, see table under C1) at V_{CC2} will be helpful.

Under extreme EMI conditions as placing an RF-transmitter antenna on top of the transceiver, we recommend to protect all inputs by a low-pass filter, as a minimum a 12 pF capacitor, especially at the RXD port. The transceiver itself withstands EMI at GSM frequencies above 500 V/m. When interference is observed, the wiring to the inputs picks it up. It is verified by DPI measurements that as long as the interfering RF - voltage is below the logic threshold levels of the inputs and equivalent levels at the outputs no interferences are expected.

One should keep in mind that basic RF - design rules for circuits design should be taken into account. Especially longer signal lines should not be used without termination. See e.g. “The Art of Electronics” Paul Horowitz, Winfield Hill, 1989, Cambridge University Press, ISBN: 0521370957.

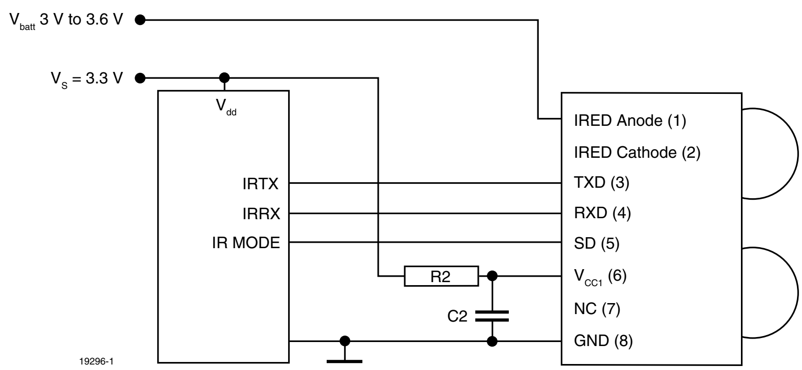


Fig. 2 - Typical Application Circuit

Figure 2 shows an example of a typical application for to work with a separate supply voltage V_S and using the transceiver with the IRED Anode connected to the unregulated battery V_{batt}. This method reduces the peak load of the regulated power supply and saves therefore costs. Alternatively all supplies can also be tied to only one voltage source. R1 and C1 are not used in this case and are depending on the circuit design in most cases not necessary.

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.

For operating at RS232 ports we recommend to use an encoder / decoder-module.

Note

- TFDU4301 echoes the TXD signal at the RXD output during transmission. For communication this signal is to be correctly ignored by the controller or the software. The echo signal is implemented for test purposes in mass production

TABLE 2 - TRUTH TABLE

INPUTS			OUTPUTS		REMARK
SD	TXD	OPTICAL INPUT IRRADIANCE mW/m^2	RXD	TRANSMITTER	OPERATION
High > 1 ms	x	x	Weakly pulled (500 kΩ) to V_{CC1}	0	Shutdown
Low	High	x	Low (active)	I_e	Transmitting
Low	High > 100 µs	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

RECOMMENDED SOLDER PROFILES

Solder Profile for Sn/Pb Soldering

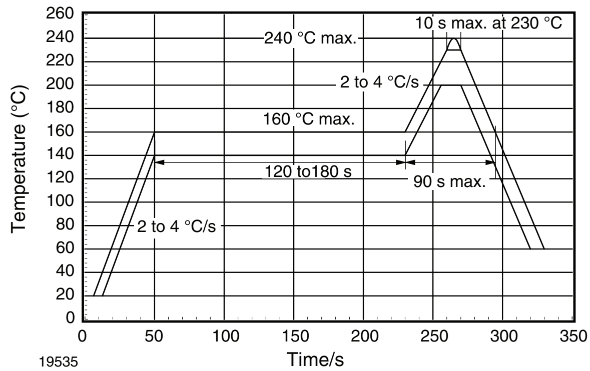


Fig. 3 - Recommended Solder Profile for Sn/Pb Soldering

Lead (Pb)-free, Recommended Solder Profile

The TFDU4301 is a lead (Pb)-free transceiver and qualified for lead (Pb)-free processing. For lead (Pb)-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 5 and 6 are VISHAY's recommended profiles for use with the TFDU4301 transceivers. For more details please refer to the application note "SMD Assembly Instructions".

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.

Wave Soldering

For TFDUxxxx, TFBSxxxx, and TFBRxxxx transceiver devices wave soldering is not recommended.

Manual Soldering

Manual soldering is the standard method for lab use. However, for a production process it cannot be recommended because the risk of damage is highly dependent on the experience of the operator. Nevertheless, we added a chapter to the above mentioned application note, describing manual soldering and desoldering.

Storage

The storage and drying processes for all VISHAY transceivers (TFDUxxxx, TFBSxxxx, and TFBRxxxx) are equivalent to MSL4.

The data for the drying procedure is given on labels on the packing and also in the application note "Taping, Labeling, Storage and Packing".

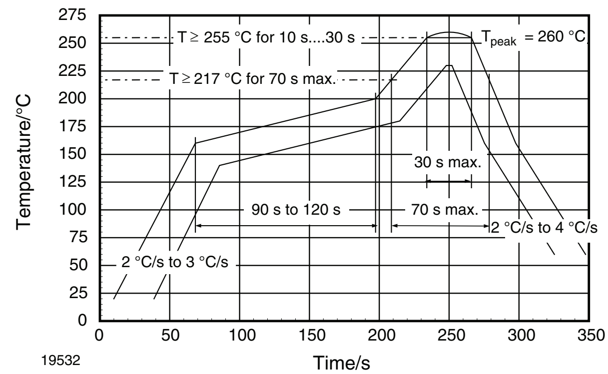


Fig. 4 - Solder Profile, RSS Recommendation

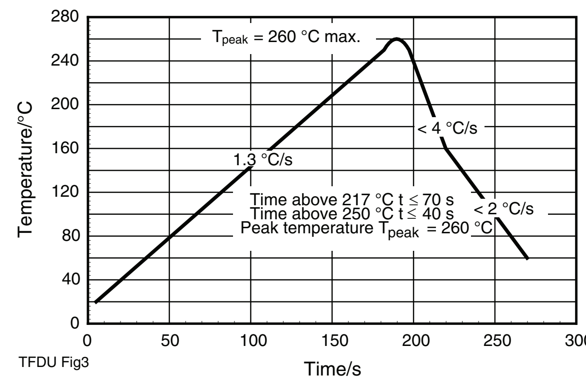
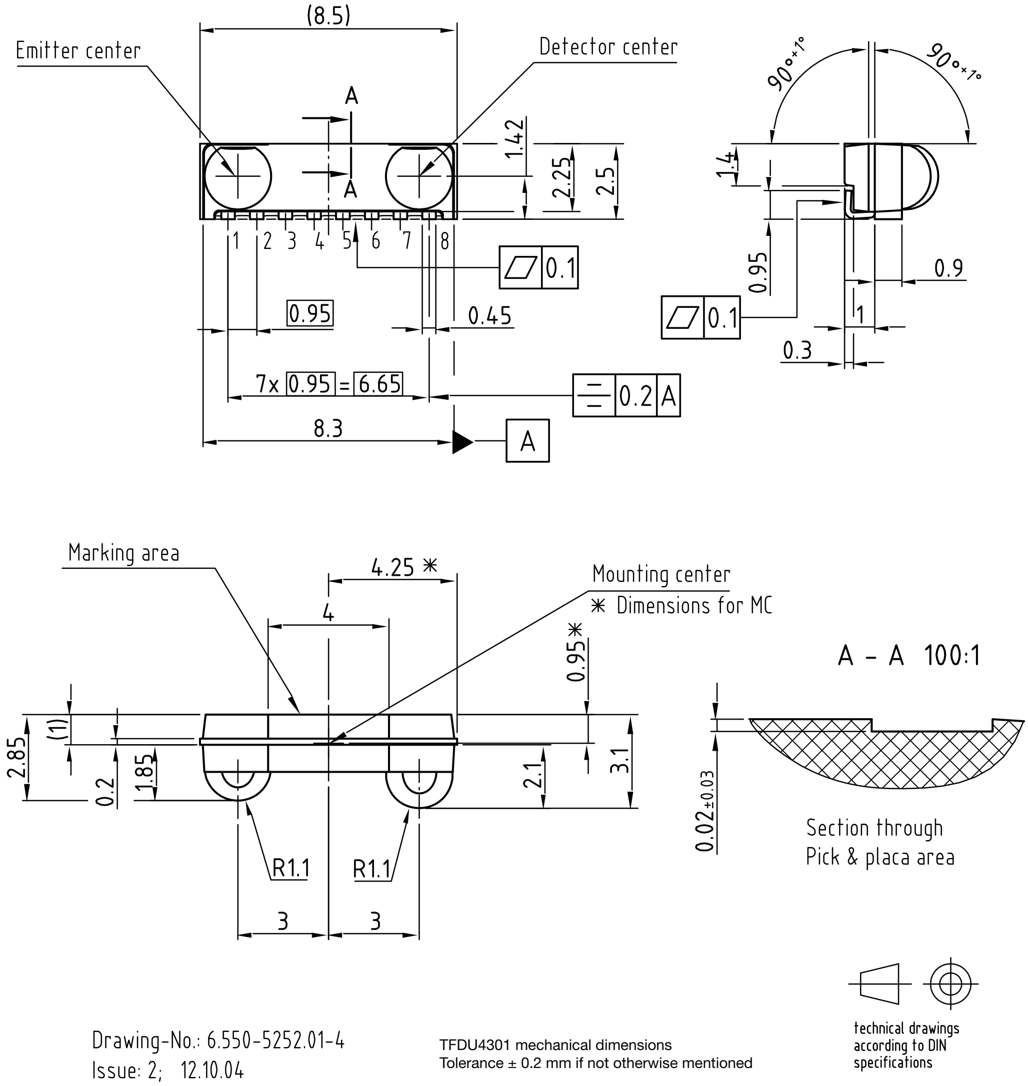


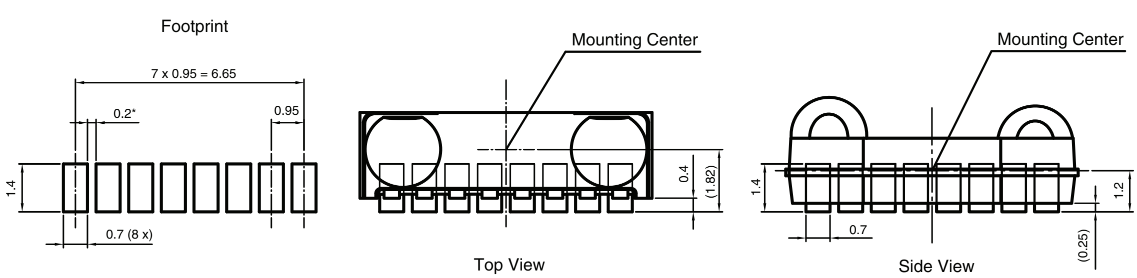
Fig. 5 - RTS Recommendation

PACKAGE DIMENSIONS in millimeters



TFDU4301 mechanical dimensions
Tolerance ± 0.2 mm if not otherwise mentioned

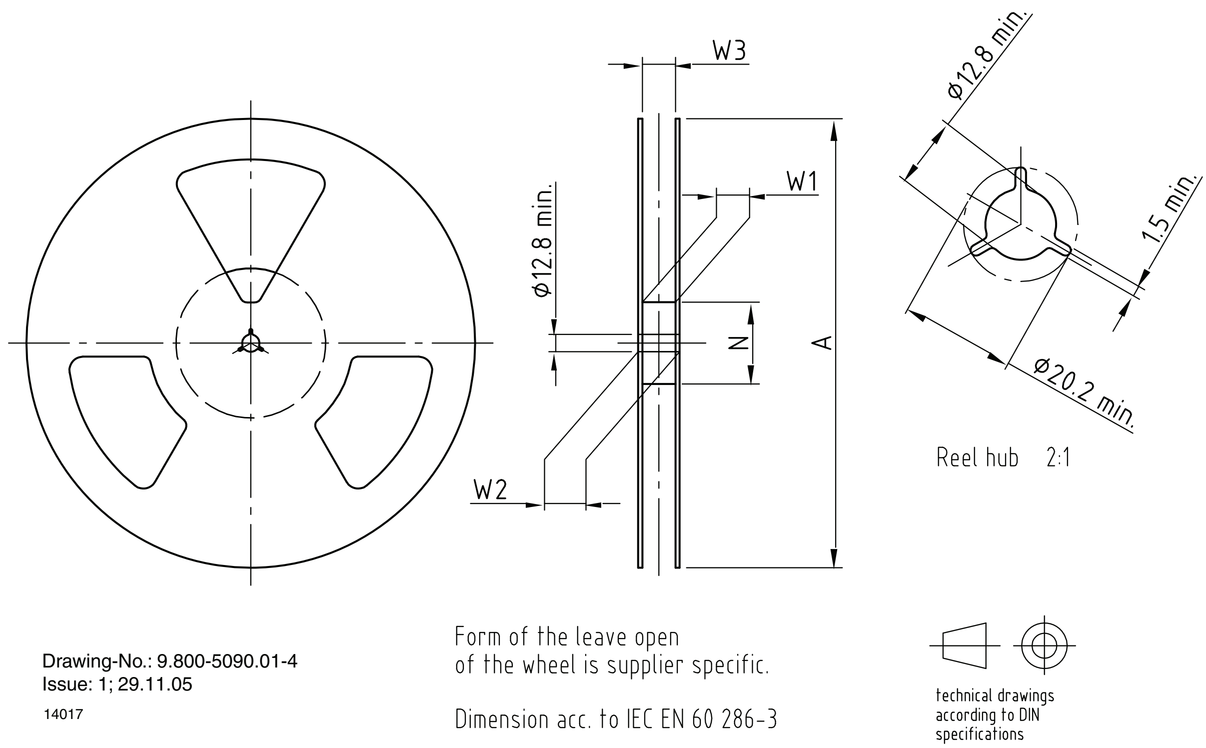
20627



* min 0.2 Photoimageable
solder mask recommended
between pads to prevent bridgeing

20626

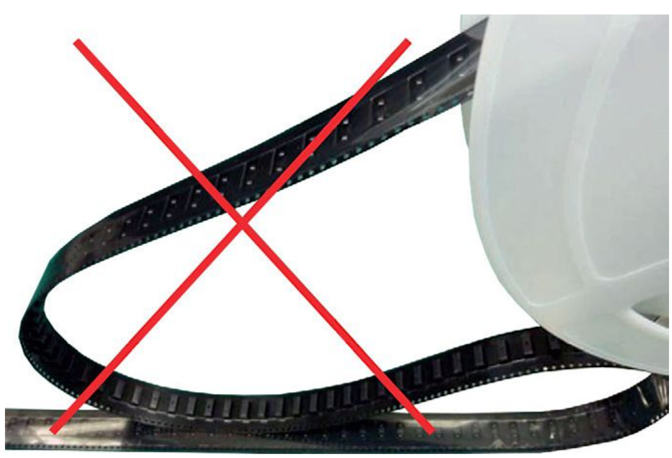
REEL DIMENSIONS in millimeters



TAPE WIDTH (mm)	A MAX. (mm)	N (mm)	W_1 MIN. (mm)	W_2 MAX. (mm)	W_3 MIN. (mm)	W_3 MAX. (mm)
16	180	60	16.4	22.4	15.9	19.4
16	330	50	16.4	22.4	15.9	19.4

HANDLING PRECAUTION

Sagging of carrier tape may cause some units to rotate and will result to pick-and-place problem. Do not allow carrier tape to sag as shown in picture below.



TAPE DIMENSIONS FOR TT1 AND TT3 in millimeters

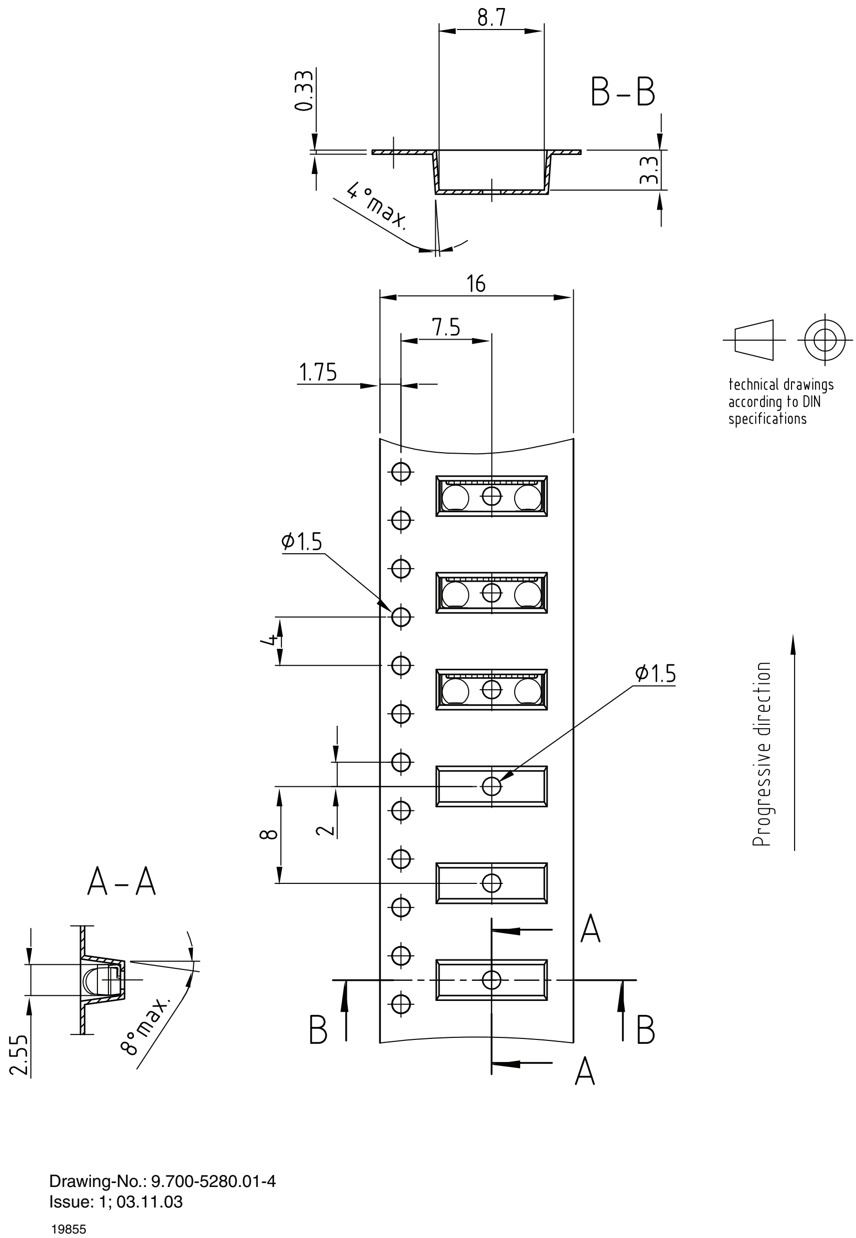


Fig. 6 - Tape Drawing, TFDU4301 for Top View Mounting

TAPE DIMENSIONS FOR TR1 AND TR3 in millimeters

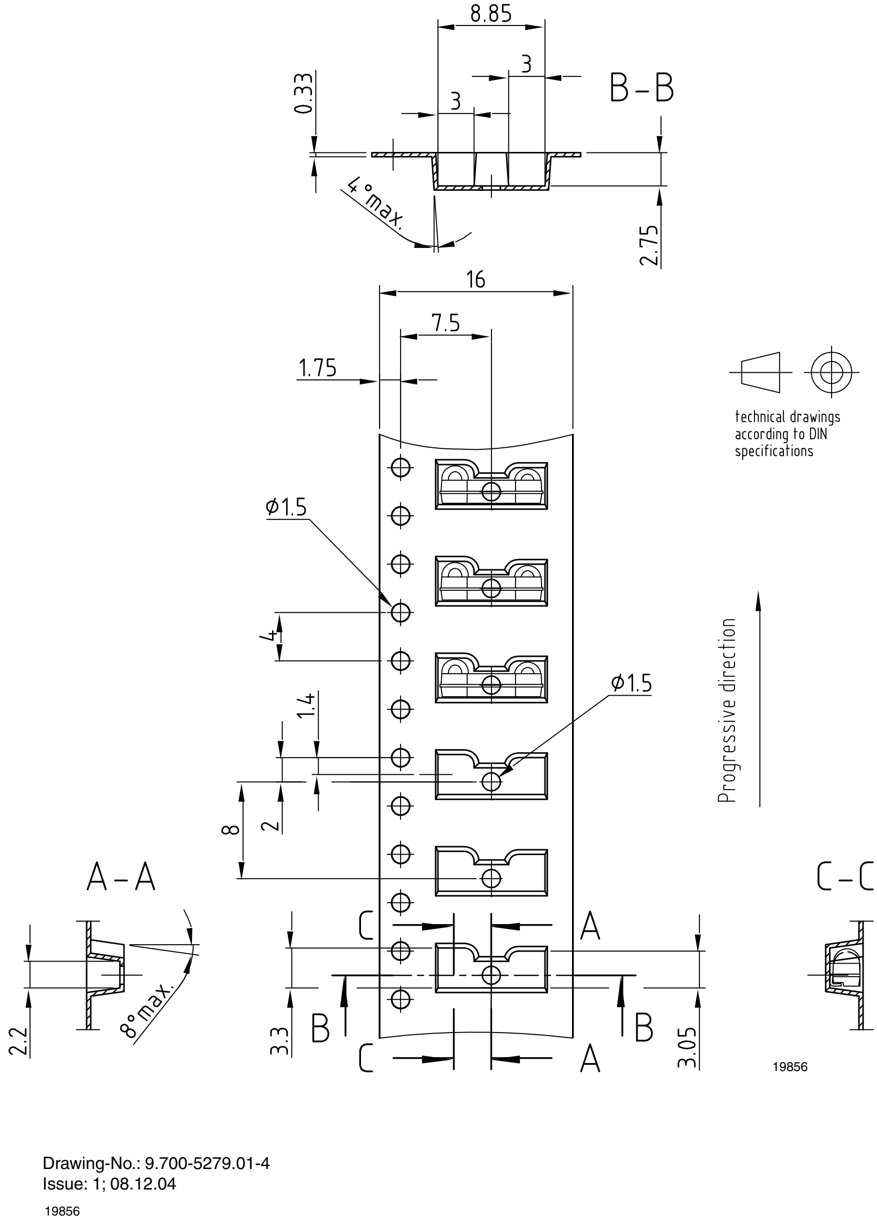


Fig. 7 - Tape Drawing, TFDU4301 for Side View Mounting

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