5 V Fast Infrared Transceiver Module Family (FIR, 4 Mbit/s)

Description

The TFDU6100, TFDS6500, and TFDT6500 are a family of low–power infrared transceiver modules compliant to the IrDA 1.2 standard for fast infrared (FIR) data communication, supporting IrDA speeds up to 4.0 Mbit/s, HP-SIR, Sharp ASK and carrier based remote control modes up to 2 MHz. Integrated within the transceiver modules are a photo PIN diode, infrared emitter (IRED), and a low–power CMOS control IC to provide a total front–end solution in a single package. Vishay Telefunken's FIR transceivers are available in three package options, including our Baby Face package (TFDU6100), the smallest FIR transceiver available on the market. This wide selection provides flexibility for a variety of applications and space constraints. The transceivers are capable of directly interfacing with a wide variety of I/O chips which perform the modulation/demodulation function, including National Semiconductor's PC87338, PC87108 and PC87109, SMC's FDC37C669, FDC37N769 and CAM35C44, and Hitachi's SH3. At a minimum, a current–limiting resistor in series with the infrared emitter and a V_{CC} bypass capacitor are the only external components required to implement a complete solution.

Features

- Compliant to IrDA 1.2 (Up to 4 Mbit/s), HP–SIR®, Sharp ASK® and TV Remote

- For 4.5 V to 5.5 V Operating Voltage

- Low–Power Consumption (5 mA Supply Current)

- Power Shutdown Mode (35 μA Shutdown Current)

- Three Surface Mount Package Options
  - Universal ($9.7 \times 4.7 \times 4.0$ mm)
  - Side View ($13.0 \times 5.95 \times 5.3$ mm)
  - Top View ($13.0 \times 7.6 \times 5.95$ mm)

- Baby Face (Universal) Package Capable of Surface Mount Solderability to Side and Top View Orientation

- Directly Interfaces with Various Super I/O and Controller Devices

- Built–In EMI Protection – No External Shielding Necessary

- Few External Components Required

- Backward Compatible to all Telefunken SIR and FIR Infrared Transceivers

Applications

- Notebook Computers, Desktop PCs, Palmtop Computers (Win CE, Palm PC), PDAs

- Digital Still and Video Cameras

- Printers, Fax Machines, Photocopiers, Screen Projectors

- Telecommunication Products (Cellular Phones, Pagers)

- Internet TV Boxes, Video Conferencing Systems

- External Infrared Adapters (Dongles)

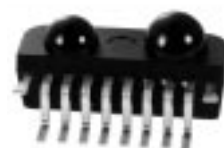- Medical and Industrial Data Collection Devices

Package Options

TFDU6100
Baby Face (Universal)

TFDS6500
Side View

TFDT6500
Top View

TFDU6100/TFDS6500/TFDT6500

Vishay Telefunken

Ordering Information

Part Number	Qty / Reel	Description
TFDU6100–TR3	1000 pcs	Oriented in carrier tape for side view surface mounting
TFDU6100–TT3	1000 pcs	Oriented in carrier tape for top view surface mounting
TFDS6500–TR3	750 pcs	
TFDT6500–TR3	750 pcs	

Functional Block Diagram
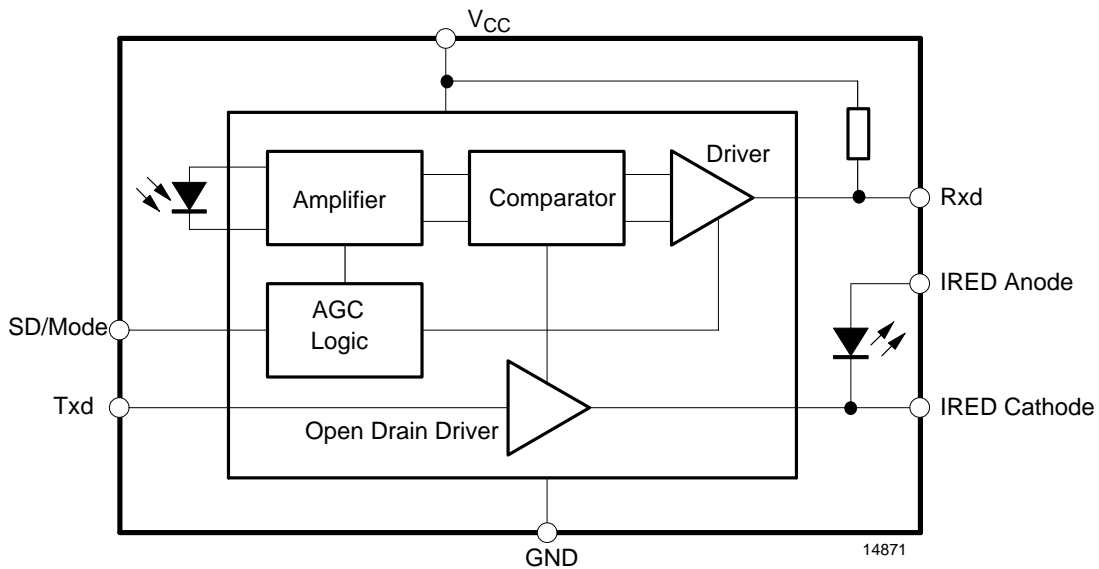
Figure 1. Functional Block Diagram

Pin Description

Pin Number		Function	Description	I/O	Active
"U" and "T" Option	"S" Option				
1	8	IRED Anode	IRED anode, to be externally connected to V_{CC} through a current control resistor		
2	1	IRED Cathode	IRED cathode, internally connected to driver transistor		
3	7	Txd	Transmit Data Input	I	HIGH
4	2	Rxd	Received Data Output, push–pull CMOS driver output capable of driving a standard CMOS or TTL load. No external pull–up or pull–down resistor is required (pin is floating when device is in shutdown mode)	O	LOW
5	6	SD/Mode	Shutdown/Mode	I	HIGH
6	3	V_{CC}	Supply Voltage		
7	5	NC	Do not connect		
8	4	GND	Ground		

"U" Option Baby Face (Universal)   **"S" Option Side View**   **"T" Option Top View**
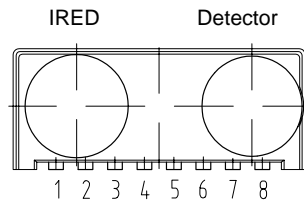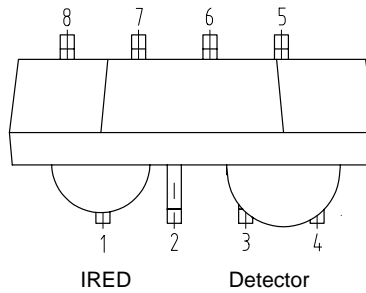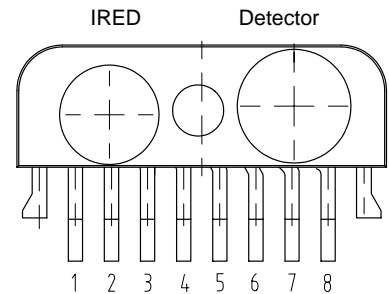
Figure 2. Pinnings

Absolute Maximum Ratings

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

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply Voltage Range		V_{CC}	− 0.5		6	V
Power Dissipation	See Derating Curve	P_D			350	mW
Junction Temperature		T_J			125	°C
Ambient Temperature Range (Operating)		T_{amb}	−25		+85	°C
Storage Temperature Range		T_{stg}	−25		+85	°C
Soldering Temperature	See Recommended Solder Profile (see figure 9)				240	°C
Average Output Current		I_{IRED} (DC)			130	mA
Repetitive Pulsed Output Current	<90 µs, t_{on} <20%	I_{IRED} (RP)			600	mA
IRED Anode Voltage		V_{IREDA}	− 0.5		V_{CC}+0.5	V
Transmitter Data Input Voltage		V_{Txd}	− 0.5		V_{CC}+0.5	V
Receiver Data Output Voltage		V_{Rxd}	− 0.5		V_{CC}+0.5	V
Virtual Source Size	Method: (1−1/e) encircled energy	d	2.5	2.8		mm
Maximum Intensity for Class 1 Operation of IEC825−1 or EN60825−1 (worst case IrDA FIR pulse pattern)	EN60825, 1997				320	mW/sr

Electrical Characteristics

$T_{amb} = 25°C$, $V_{CC} = 5.0$ V unless otherwise noted.
Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

Parameters	Test Conditions / Pins	Symbol	Min.	Typ.	Max.	Unit
Transceiver						
Supply Voltage		V_{CC}	4.5	5	5.5	V
Dynamic Supply Current	SD = Low Receive mode only. In transmit mode, add additional 100 mA (typ) for IRED current.	I_{CC}		5	7	mA
Standby Supply Current	SD = V_{CC} −0.5	I_{SD}		35	100	µA
Operating Temperature Range		T_A	−25		+85	°C
Output Voltage Low	$I_{OL} = 2.5$ mA	V_{OL}		0.3	0.5	V
Output Voltage High	$I_{OH} = -2.5$ mA	V_{OH}	V_{CC}−0.5			V
Input Voltage Low (T_{xd})		V_{IL}	0		0.8	V
Input Voltage High (T_{xd})		V_{IH}	3.5			V
Input Voltage Low (SD/Mode)		V_{IL}	0		0.8	V
Input Voltage High (SD/Mode)		V_{IH}	V_{CC} −0.5			V
Input Leakage Current		I_L	−10		+10	µA
Input Capacitance		C_I			5	pF

Optoelectronic Characteristics

$T_{amb} = 25°C$, $V_{CC} = 5.0$ V unless otherwise noted.
Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Receiver						
Minimum Detection Threshold Irradiance	9.6 kbit/s to 115.2 kbit/s, $\lambda = 850$ nm – 900 nm	E_e		25	35	mW/m^2
	1.152 Mbit/s to 4 Mbit/s, $\lambda = 850$ nm – 900 nm	E_e		70	80	mW/m^2
Maximum Detection Threshold Irradiance		E_e	5	10		kW/m^2
Logic LOW Receiver Input Irradiance		E_e	4			mW/m^2
Rise Time of Output Signal	10% to 90%, @2.2 kΩ, 15pF	$t_{r\,(Rxd)}$	10		40	ns
Fall Time of Output Signal	90% to 10%, @2.2 kΩ, 15pF	$t_{f\,(Rxd)}$	10		40	ns
Rxd Pulse Width of Output Signal, 50%	Input pulse length 20 μs, 9.6 kbit/s	t_{PW}	0.8		20	μs
	Input pulse length 125 ns, 4.0 Mbit/s mode	t_{PW}	60		165	ns
	Input pulse length 250 ns, 4.0 Mbit/s mode (double pulse)	t_{PW}	185		290	ns
Jitter, Leading Edge	Input Irradiance = 90 mW/m^2, 4.0 Mbit/s mode				10	ns
Latency		t_L			120	μs
Transmitter						
IRED Operating Current	R1 = 7.2 Ω, $V_{CC} = 5.0$ V	I_D		0.4	0.55	A
Output Radiant Intensity	Vcc = 5.0 V, $\alpha = 0°$, 15° Txd = Low or SD = High (Receiver is inactive as long as SD = High) R1 = 7.2 Ω	I_e			0.04	mW/sr
	Vcc = 5.0 V, $\alpha = 0°$, 15° Txd = High, SD = Low, R1 = 7.2 Ω	I_e	100	140	320	mW/sr
Radiant Intensity, Half – Intensity Angle		$\alpha_{1/2}$		±24		°
Peak – Emission Wavelength		λ_P	880		900	nm
Optical Rise Time, Fall Time		t_{ropt}, t_{fopt}	10		40	ns
Optical Overshoot					25	%

Recommended Circuit Diagram

The only required component for designing an IrDA 1.2 compatible design using Telefunken FIR transceivers is a current limiting resistor, R1, to the IRED. However, depending on the entire system design and board layout, additional components may be required (see figure 3).
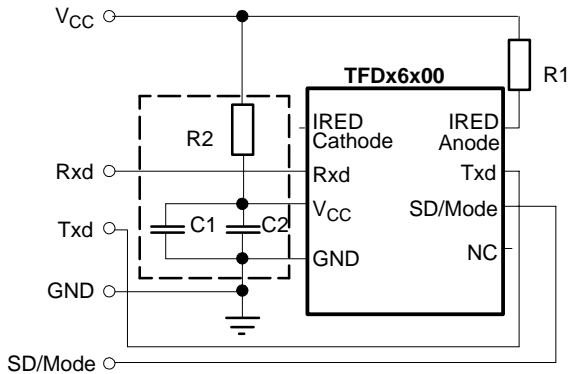
Note: Outlined components are optional depending on the quality of the power supply.

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Figure 3. Recommended Application Circuit

Telefunken FIR 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/Mode) and the output Rxd should be directly (DC) coupled to the I/O circuit.

R1 is used for controlling the current through the IR emitter. For increasing the output power of the IRED, the value of the resistor should be reduced. Similarly, to reduce the output power of the IRED, the value of the resistor should be increased. For typical values of R1 see figure 4. For IrDA compliant operation, a current control resistor of 7.2 Ω is recommended. The upper drive current limitation is dependent on the duty cycle and is given by the absolute maximum ratings on the data sheet.

R2, C1 and C2 are optional and dependent on the quality of the supply voltage V_{CC} and injected noise. An unstable power supply with dropping voltage during transmission may reduce sensitivity (and transmission range) of the transceiver.
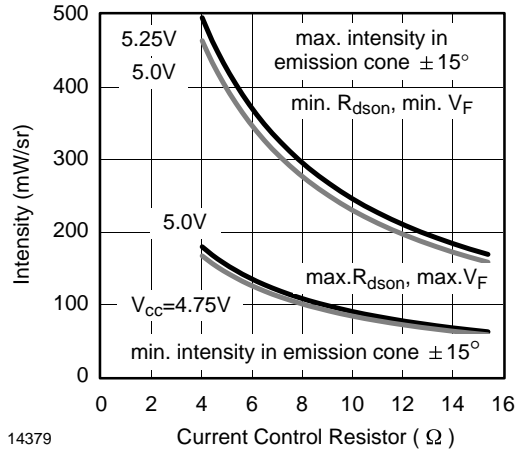
Figure 4. Intesity I_e vs. Current Control Resistor R1

The placement of these parts is critical. It is strongly recommended to position C2 as near as possible to the transceiver power supply pins. A tantalum capacitor should be used for C1 while a ceramic capacitor is used for C2. Also, when connecting the described circuit to the power supply, low impedance wiring should be used.

Table 1. Recommended Application Circuit Components

Component	Recommended Value
C1	4.7 μF, Tantalum
C2	0.1 μF, Ceramic
R1	7.2 Ω , 0.25 W (recommend using two 3.6 Ω, 0.125 W resistors in series)
R2	47 Ω , 0.125 W

Mode Switching

The TFDU6100, TFDS6500 and TFDT6500 powers on with a default of low frequency mode.

The low frequency mode covers speeds up to 115.2 kbit/s. Signals with higher data rates should be detected in the high frequency mode. Lower frequency data can also be received in the high frequency mode but with reduced sensitivity. To switch the transceivers from low frequency mode to the 4.0 Mbit/s mode and vice versa, the programming sequences described below are required.
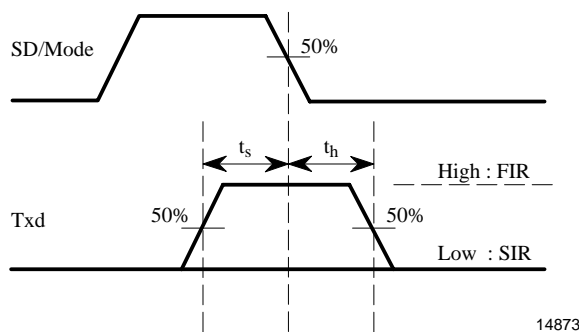

Figure 5. Mode Switching Timing Diagram

Setting to the High Bandwidth Mode (0.576 Mbit/s to 4.0 Mbit/s)

1. Set SD/MODE input to logic "HIGH".

2. Set Txd input to logic "HIGH". Wait $t_s \geq 200$ ns.

3. Set SD/MODE to logic "LOW" (this negative edge latches state of Txd, which determines speed setting).

4. After waiting $t_h \geq 200$ ns Txd can be set to logic "LOW". The hold time of Txd is limited by the maximum allowed pulse length.

Txd is now enabled as normal Txd input for the high bandwidth mode.

Setting to the Lower Bandwidth Mode (2.4 kbit/s to 115.2 kbit/s)

1. Set SD/MODE input to logic "HIGH".

2. Set Txd input to logic "LOW". Wait $t_s \geq 200$ ns.

3. Set SD/MODE to logic "LOW" (this negative edge latches state of Txd, which determines speed setting).

4. Txd must be held for $t_h \geq 200$ ns.

Txd is now enabled as normal Txd input for the lower bandwidth mode.

Recommended SMD Pad Layout

The leads of the device should be soldered in the center position of the pads.
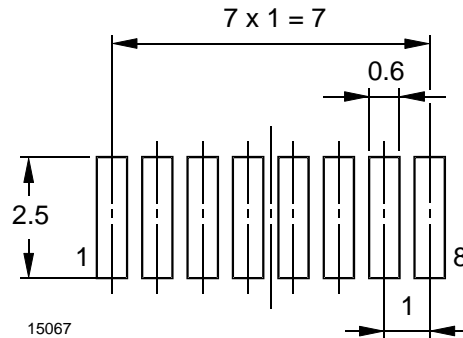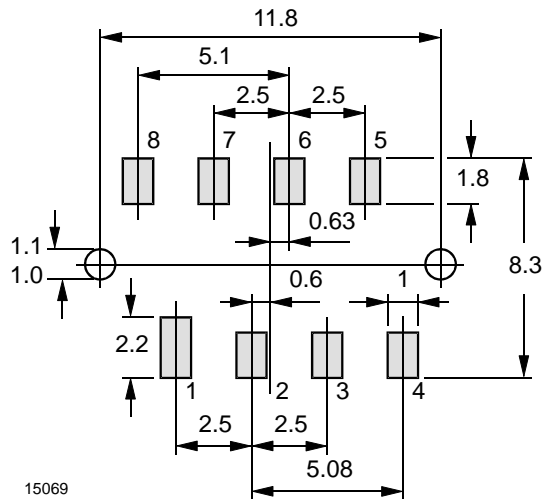
Figure 6. TFDU6100 BabyFace (Universal)

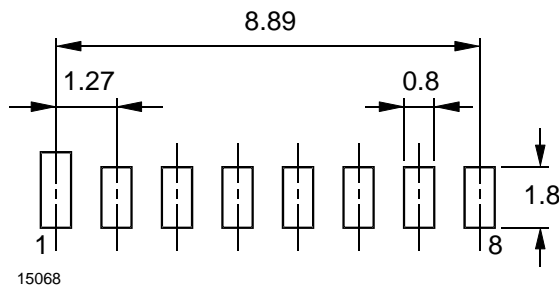Figure 7. TFDS6500 Side View Package

Figure 8. TFDT6500 Top View Package
Note: Leads of the device should be at least 0.3 mm within the ends of the pads.
Pad 1 is longer to designate Pin 1 connection to transceiver.
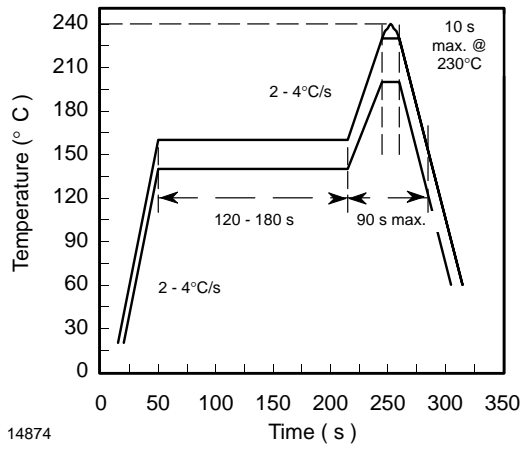
Recommended Solder Profile

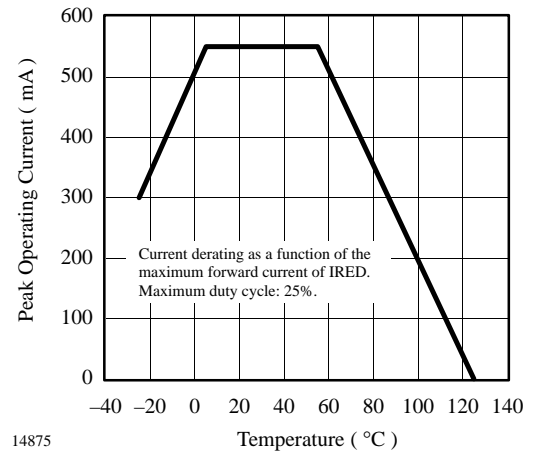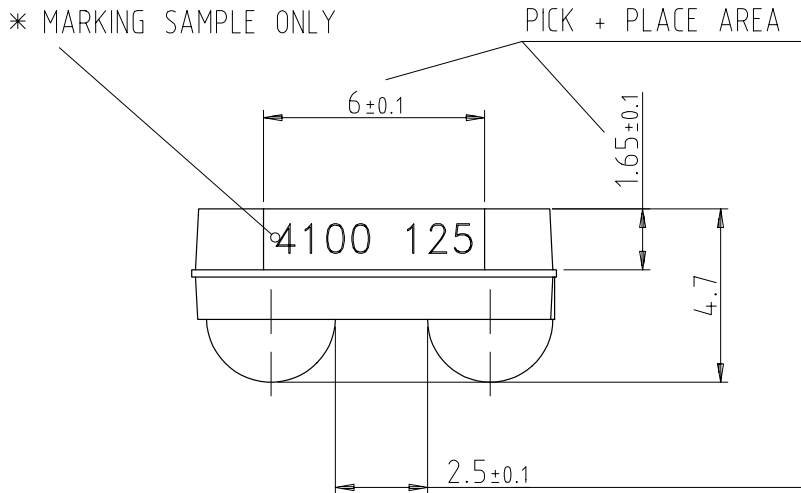14874
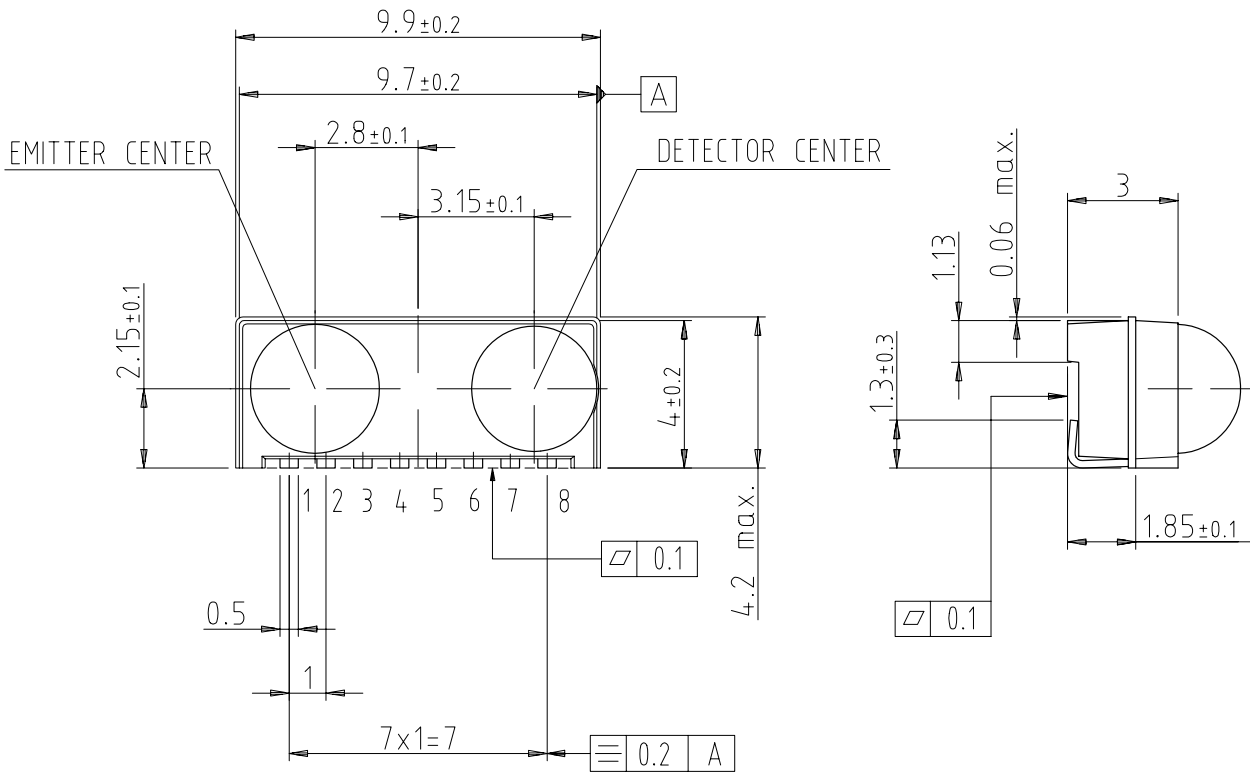
Figure 9. Recommended Solder Profile

Current Derating Diagram

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Figure 10. Current Derating Diagram

TFDU6100 – Baby Face (Universal) Package (Mechanical Dimensions)

* MARKING SAMPLE ONLY

* MARKING ORIENTATION
180 DEGREES ALLOWED
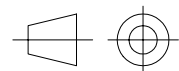
Drawing-No.: 6.550-5148.01-4
Issue: 8; 10.7.98

12249

technical drawings
according to DIN
specifications

TFDS6500 – Side View Package (Mechanical Dimensions)

EMITTER CENTER

DETECTOR CENTER

EJECTION MARKS Ø1.8 ±0.25
FRONT AND BACKSIDE

MARKING SAMPLE ONLY

TANGENTIAL
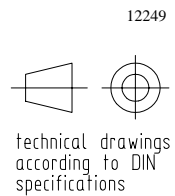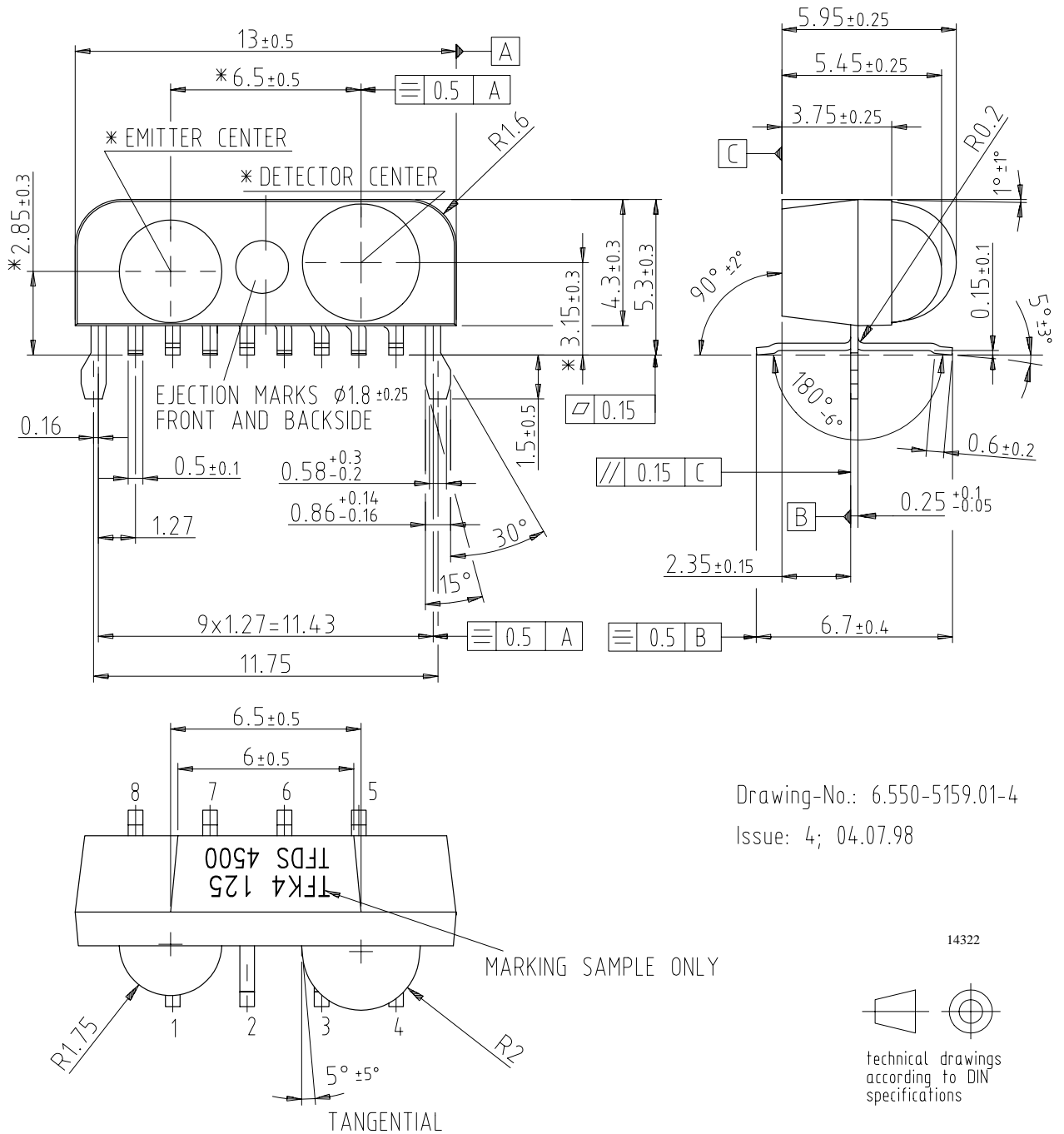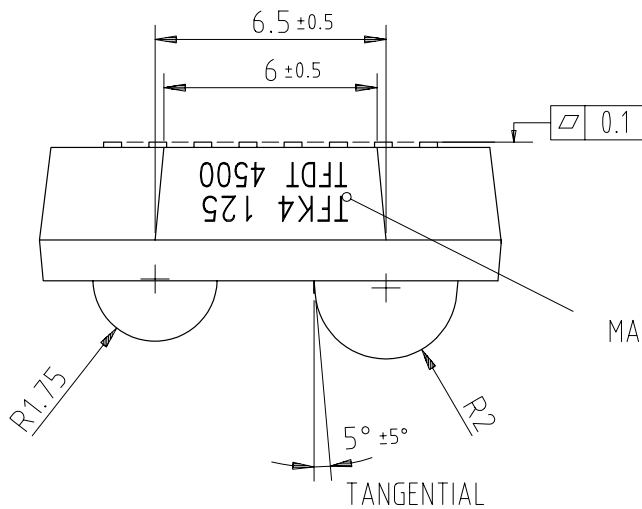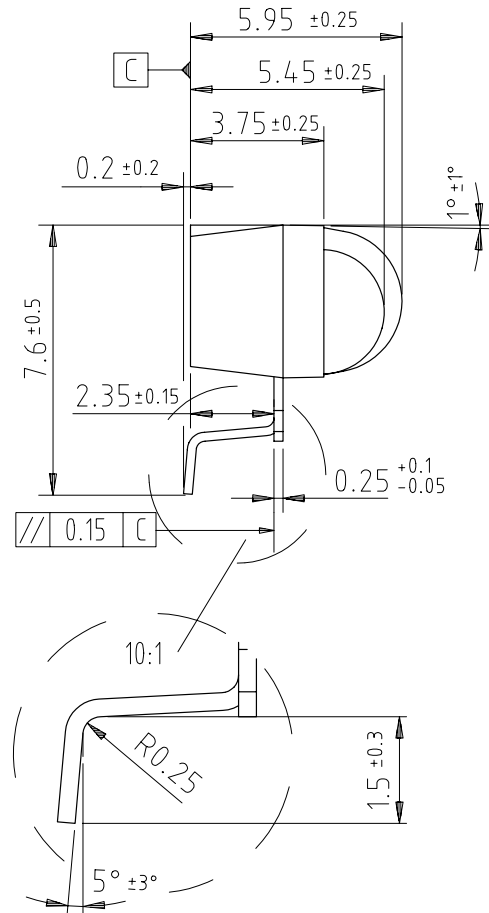
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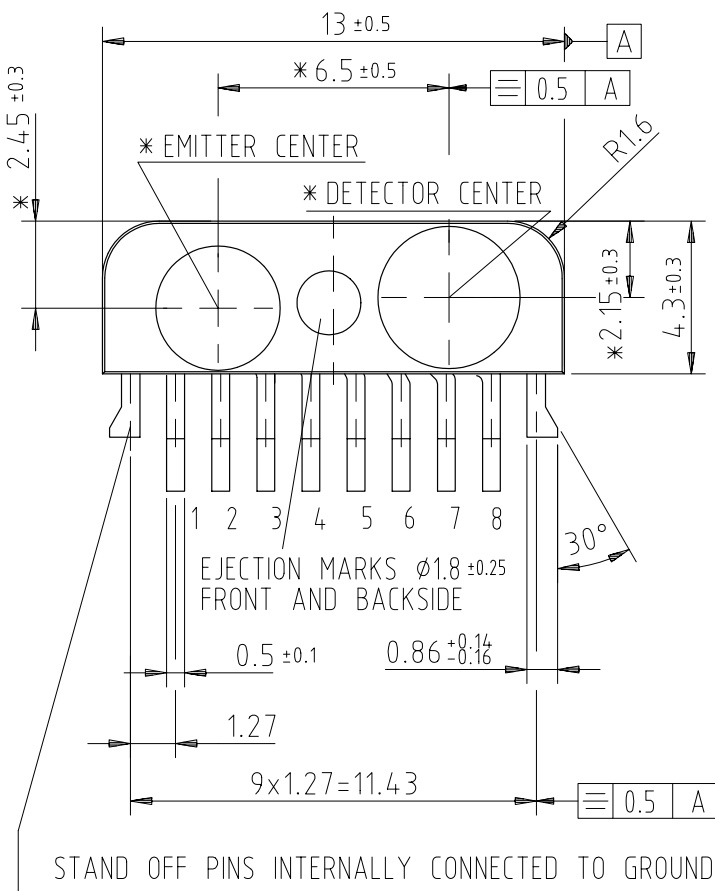Issue: 4; 04.07.98

14322

technical drawings
according to DIN
specifications

TFDT6500 – Top View Package (Mechanical Dimensions)

13 ±0.5   A

6.5 ±0.5   0.5 A

2.45 ±0.3

EMITTER CENTER

DETECTOR CENTER

R1.6

2.15 ±0.3
4.3 ±0.3

1 2 3 4 5 6 7 8

30°

EJECTION MARKS Ø1.8 ±0.25
FRONT AND BACKSIDE

0.5 ±0.1   0.86 +0.14 -0.16

1.27

9 x 1.27 = 11.43   0.5 A

STAND OFF PINS INTERNALLY CONNECTED TO GROUND

5.95 ±0.25
C
5.45 ±0.25
3.75 ±0.25
0.2 ±0.2
1° ±1°

7.6 ±0.5

2.35 ±0.15
0.25 +0.1 -0.05

// 0.15 C

10:1
R0.25
1.5 ±0.3
5° ±3°

6.5 ±0.5
6 ±0.5
0.1

TFK4 125
TFDT 4500

R1.75   R2
5° ±5°
TANGENTIAL

MARKING SAMPLE ONLY

Drawing-No.: 6.550-5160.01-4
Issue: 4; 28.07.98

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technical drawings
according to DIN
specifications
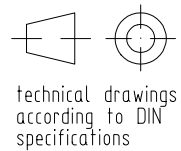
Ozone Depleting Substances Policy Statement

It is the policy of **Vishay Semiconductor GmbH** to

1. Meet all present and future national and international statutory requirements.

2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively

2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA

3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.