Product Unit

Infrared Data Communication

Reference Design Boards

Table of Contents

Reference Design Boards for Vishay Telefunken IR Transceivers

Circuit Diagrams

General Remarks

In figure 1, the circuit diagrams are given for the various transceiver package versions. The boards are designed to operate with the FIR data rates but can also be used for the SIR design -following the Vishay Telefunken philosophy of backward and forward compatibility of the designs.

The board described in the following text is designed to be connected by ribbon cable and a connector to an I/O. For testing, we recommend to use twisted pair cables. These allow cable lengths up to at least 60 cm. However, for other long cables over 30 cm length (depending on the capacitive load) line drivers might be necessary. The layout shows a pad layout to attach the twisted pairs correctly.

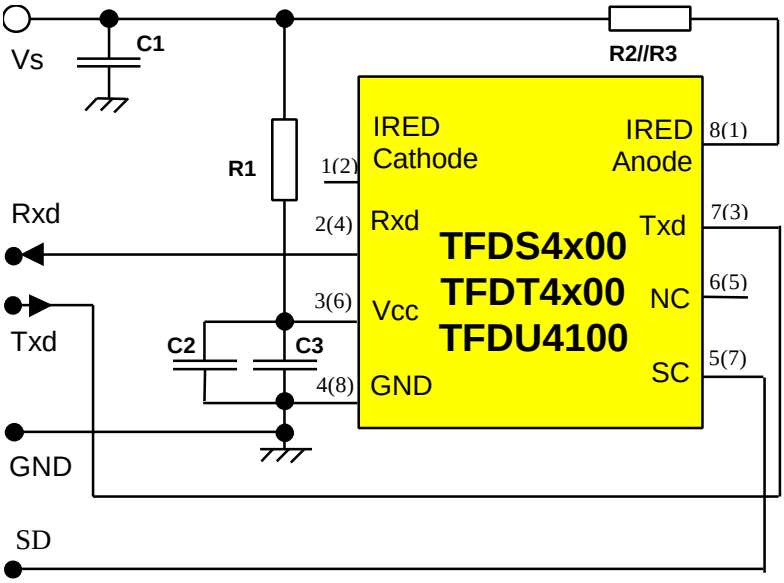
The size of the board is 27 mm x 34 mm. For easy use, we added the mounting holes to the board. If a smaller configuration without mounting holes is preferred, break off these parts at the breaking lines which results in a board size of about 15 mm by 21 mm.

Before connecting the board to the interface board, disconnect the computer from the mains.

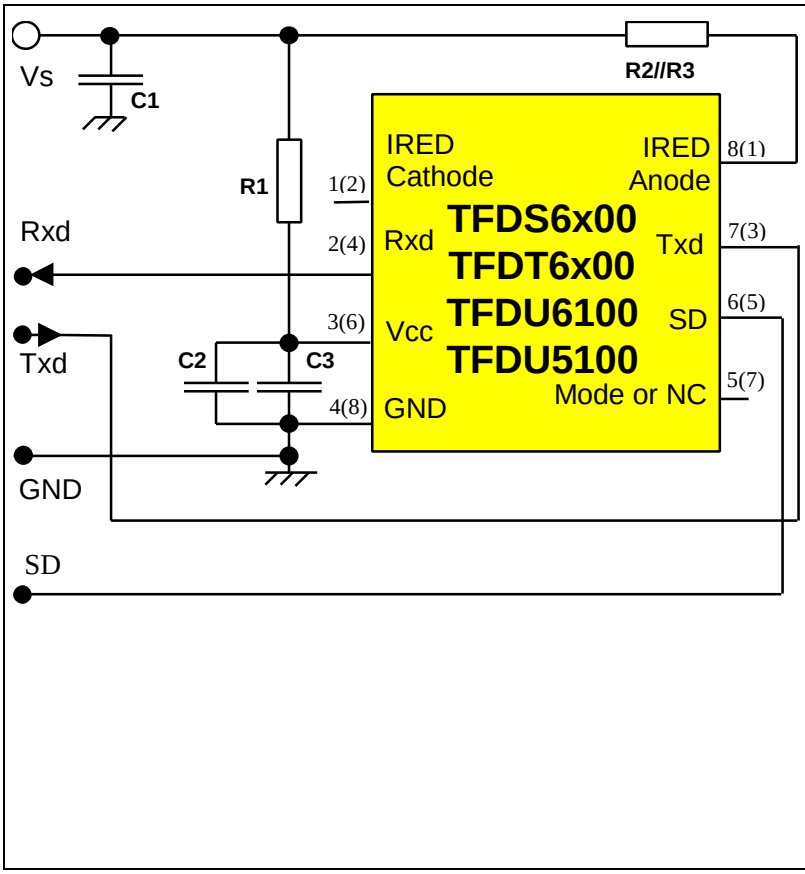
The board or Gerber plots of the board are available from Vishay Semiconductor's GmbH IRDC application unit through the sales and marketing team.

4x00 series

The TFDx4x00 devices are designed to operate up to data rates of 115 kbit/s and therefore do not have to handle such high frequencies as in the case of TFDx6x00. Nevertheless, we recommend an identical layout as in TFDx6x00. The circuit is also identical apart from the different use of pin 6(5) and pin 5(7). R2 and R3 are used in parallel for controlling the current through the IR emitter. For power dissipation, two parallel resistors are used for the emitter-current control. Due to the lower minimum output intensity for SIR applications, the current control resistor combination is also changed to larger values, see figure 2 and figure 3. Nevertheless, care should be taken that the voltage at the inputs does not exceed the specified values. For increasing the output power, reduce the value. For reducing the output power, increase the value. In figure 2 and figure 3, the intensity as a function of the serial resistor is given for 5-V and 3-V applications. The devices of the 3000 (replaced by the 4x00 series) and the 4x00 series and the 6000 series do not need an external load resistor. In case of the 4000 series a 20 kOhm resistor load is built-in. The 5000 series and 6000 series devices got push pull outputs.



Circuit diagram for TFDS4x00, TFDT4x00, and TFDU4100. The circuit diagrams for all three versions are identical but the layouts are different. The pin reference numbers refer to TFDS4x000. The pin numbers of TFDT4x00 and TFDU4100 are given in parentheses.



Circuit diagram for the 5000 and 6000(E) series. The circuit diagrams for all four versions are identical, but the layouts are different. The pin reference numbers refer to TFDS6x000. The pin numbers of TFDT6x00 and TFDUx100 are given in parentheses. The circuit is identical to the circuit described above for TFDx4y00.
However, pin 5(7) is used differently.
In the case of the 6000 series, this pin has to float: In the case of the 6500E series and TFDU5100, it can be used as mode indicator output or mode select input

Figure 1 Circuit diagrams

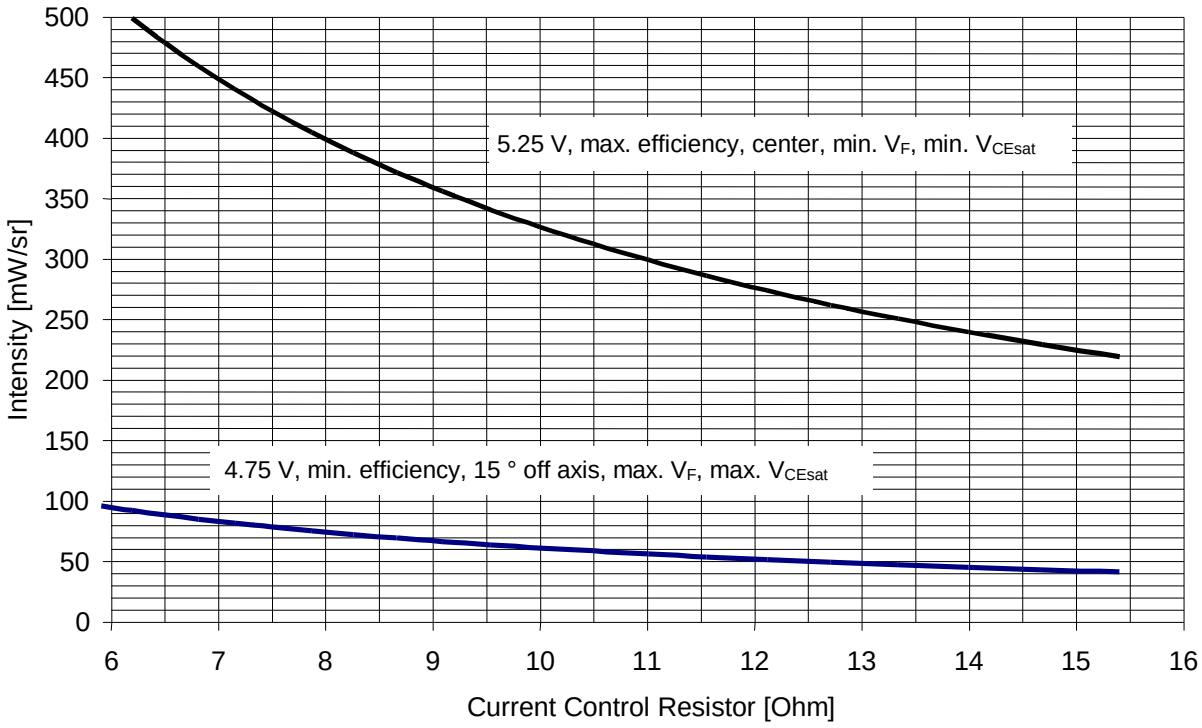


Figure 2 TFDS4x00: Intensity as a function of current control resistor. Operating voltage 5 V ±5%

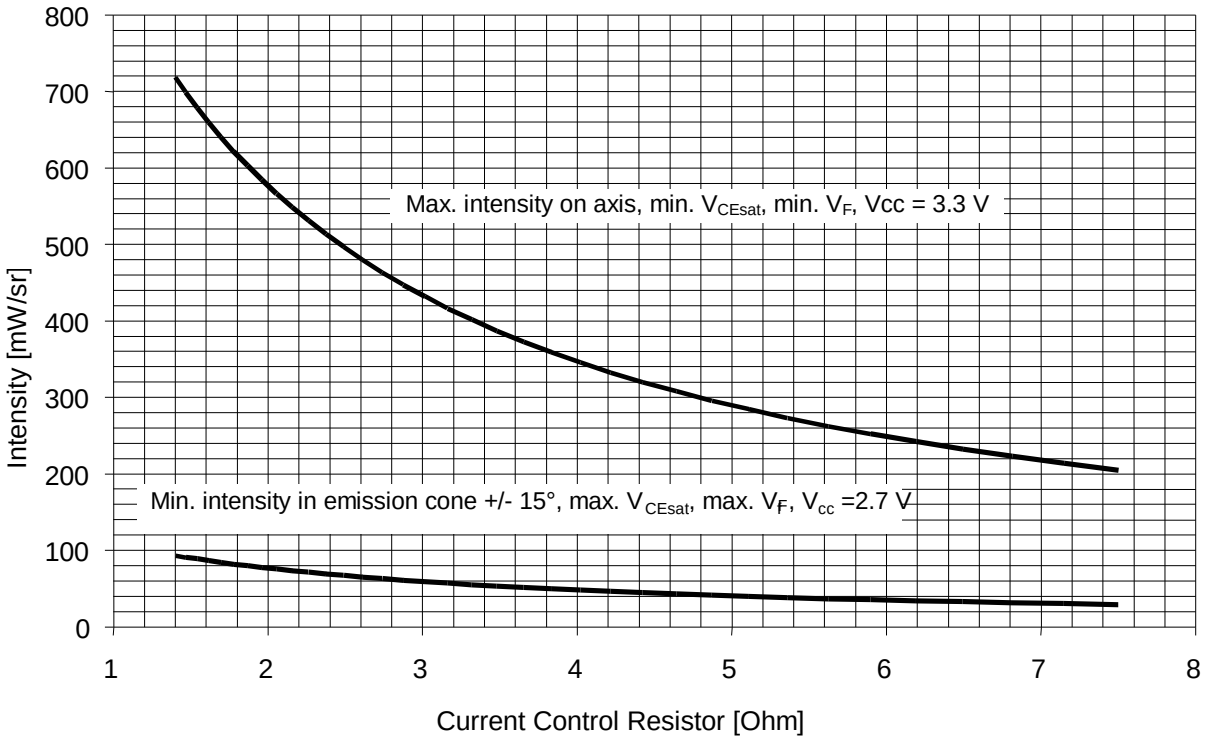


Figure 3 TFDS4x00 Intensity as a function of current control resistor. Operating voltage 3 V ±10%, The variation is mainly caused by intensity variations over the optical field of view

5000 and 6000 series

In the case of the FIR devices, a dynamic mode switching is implemented using the shutdown and TxD pins. See the data sheet of the special devices for the time required. Diagrams of the typical dependence of the intensity I_e as a function of the current control resistor are shown in figure 4 and figure 5 for different operating voltages when used in a circuit as shown in figure 1.

The 5000 and 6000(E) series devices need no external load at the push-pull output.

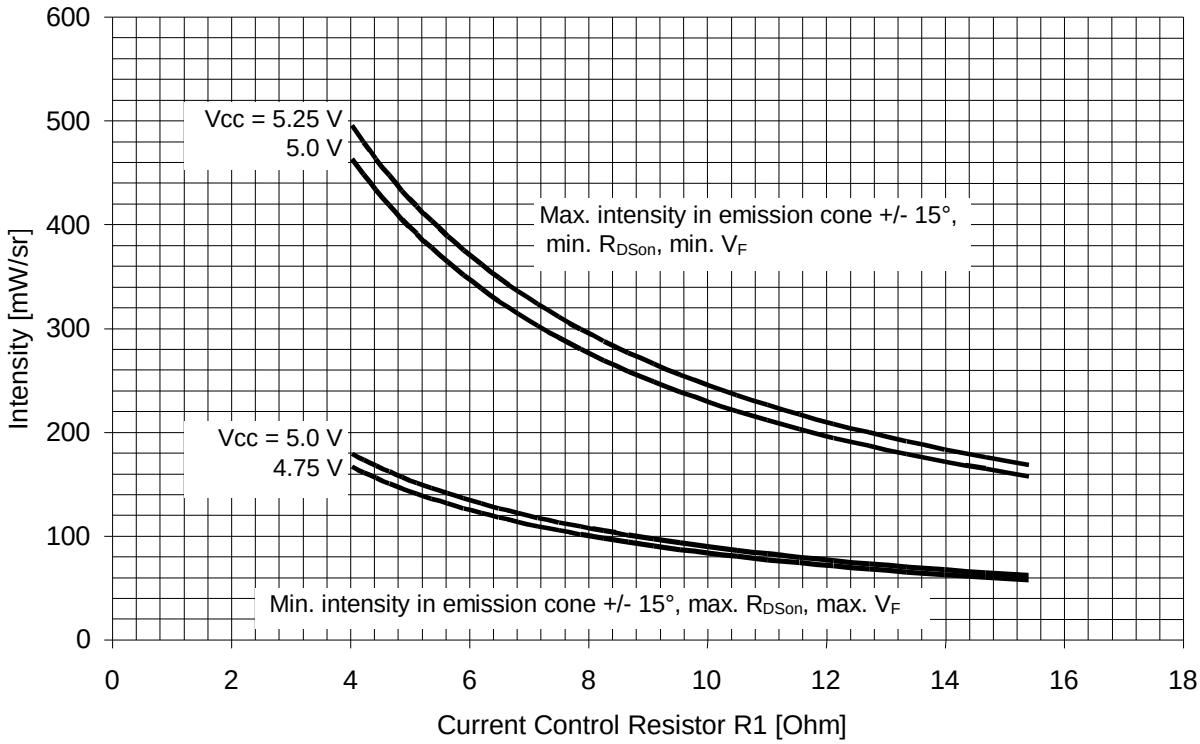


Figure 4 Intensity vs. current control resistor. The minimum curve is dominated by the drop at larger angles in the field of view and less affected by the smaller operating voltage. The max. intensity is to be found in the center operating with maximum operating voltage

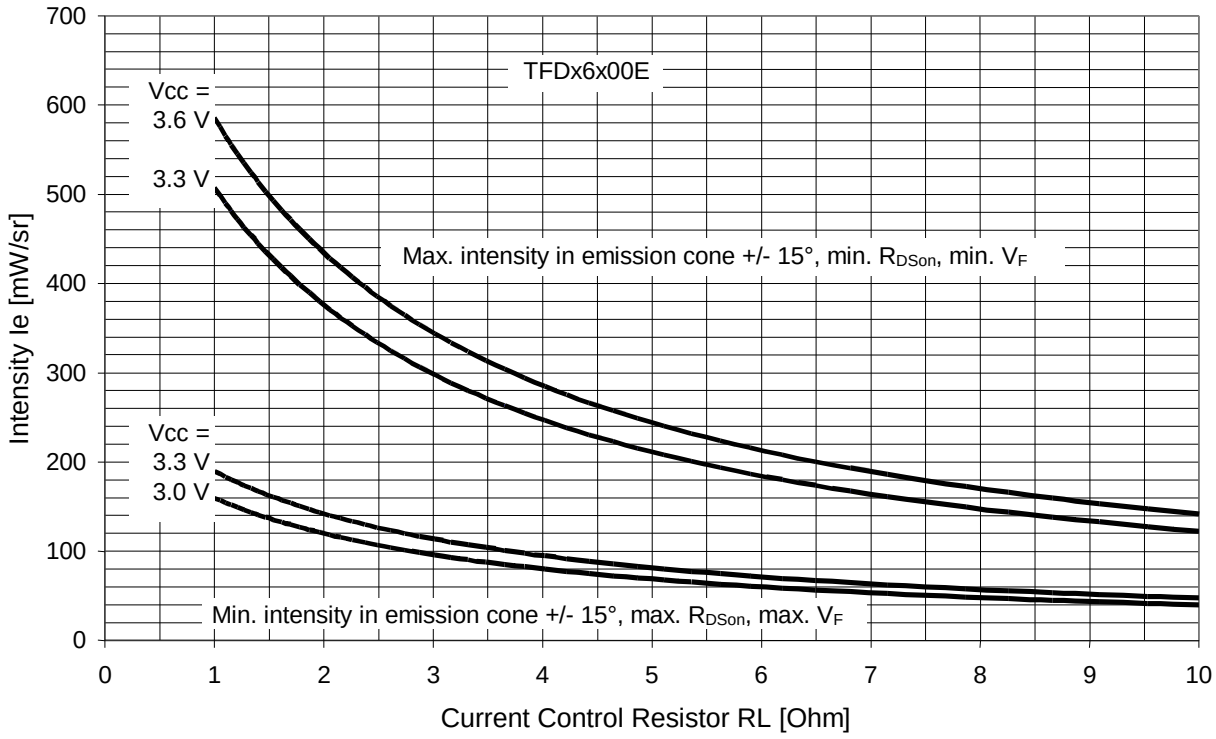


Figure 5 Intensity vs. current control resistor. The minimum curve is dominated by the drop at larger angles in the field of view and less affected by the smaller operating voltage. The max. intensity will be found in the center operating with maximum operating voltage

Power Supply

C1, C2, and C3 in figure 1 are dependent on the quality of the supply voltage. A combination of 10 µF with 470 nF and 6.8µF in combination with a lab power supply will work in nearly every case. The component placement, however, is critical. We strongly recommend positioning the ceramic capacitor of C2 and C3 as near as possible to the power supply pins (3 and 4 of side view package) as in the proposed layout.
The capacitance is strongly dependent on the power supply injected noise.
For final layouts for production, the components should also be optimized for cost reduction.

When connecting the described circuit to the power supply unit, low impedance wiring is absolutely necessary. Use an oscilloscope to check for stable power supply at Vcc. Unstable power supply with dropping voltage during transmission may reduce the sensitivity of the receiver unit.

Board Layout

The board described in the following chapter is designed to be connected by ribbon cable and a connector to a mainboard. We recommend using twisted pairs of cables. The layout shows a pad layout to attach the twisted pairs correctly.

The size of the whole board is 27 mm x 34 mm. For easy use, we added the mounting holes to the board. If a smaller configuration without mounting holes is preferred, break off these parts at the breaking lines which then results in a board size of 15 mm by 21 mm.
Before connecting the board to the interface board, disconnect the computer from the mains.
The board or Gerber plots of the board are available from Vishay Semiconductor‘s GmbH IRDC application unit via the sales and marketing force.

Board Layout for all Vishay Telefunken IR Transceiver Devices

Vishay Semiconductor GmbH provides Gerber plots and samples of the described boards. The 4 Mbit/s transceiver is the most layout sensitive device in the Vishay Telefunken transceiver family. The other pin-compatible Vishay Telefunken devices can be operated in identical layouts as shown in figure 6 and figure 8. Therefore, the boards can be used for all TFDxyz000 devices - if in case of the TFDx4x00 devices the split power supply feature is not applied.

Layout for all Vishay Telefunken side view (TFDSxxxx) IR transceivers

The layouts are done for the circuits shown in Figure1

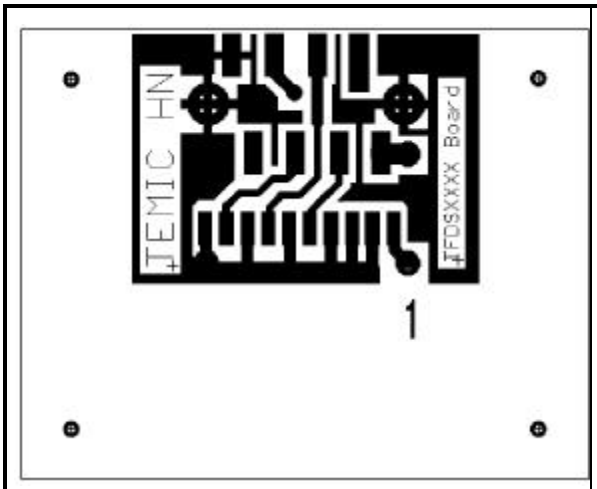
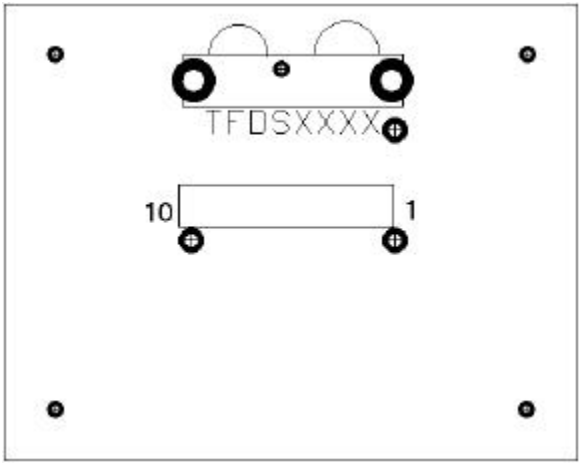
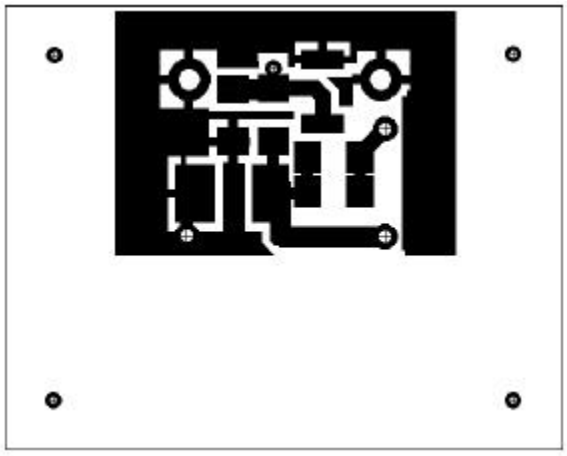
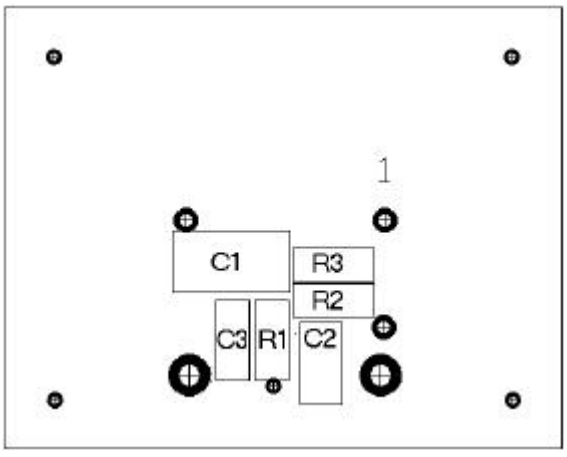
	
Layout and component placement, top side, enlarged, board size 27 x 34 mm^2, not to scale	**Pad assignment:** **GND: 2, 3, 4, 6, 8, 10** **VCC: 1** **Rxd: 7** **Txd: 5** **SD: 9**
	
Layout and component placement, bottom side	

Figure 6 Board layout for side-view applications

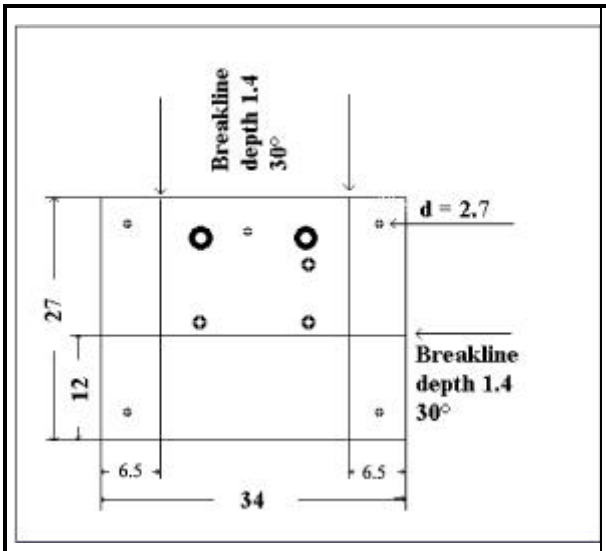
	**The test board is 15 mm x 22mm in size.** **In the lab setup, however, mounting holes to fix the board are also very helpful.** **Therefore, we added to the test board the outer frame for easy attachment in a setup.** **Breaklines are provided to break off the outer part if not used.**
Board dimensions	

Figure 7 Board dimensions for side-view transceivers

Board layout for all Vishay Telefunken top-view transceivers as TFDT4x00, TFDT5x00, TFDT6x00E

Circuit diagram see figure 1

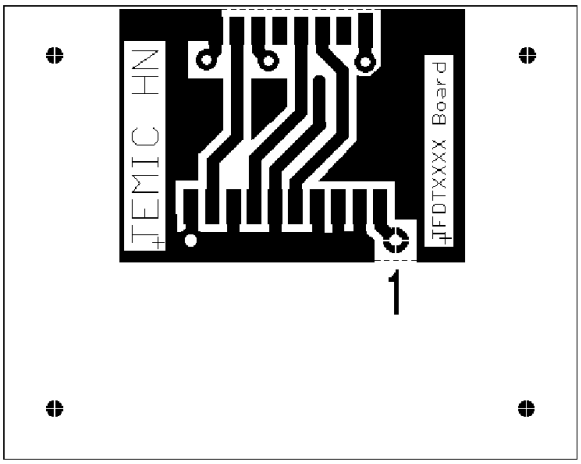
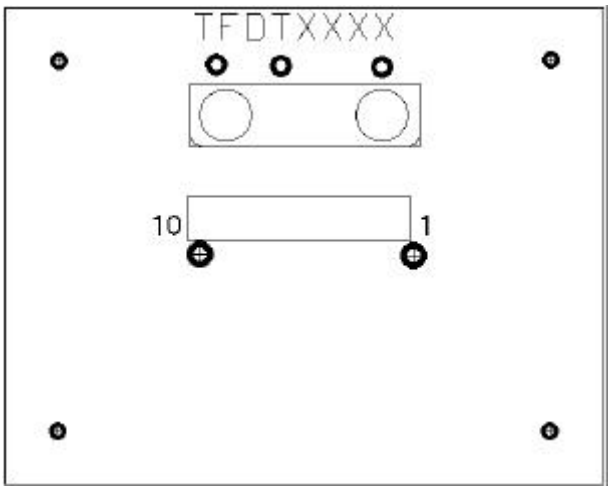
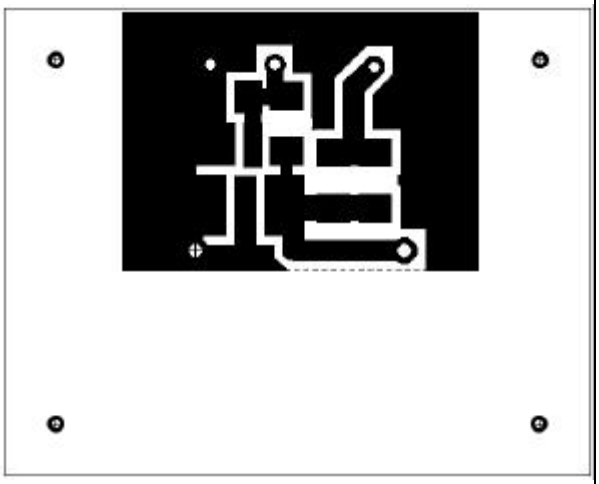
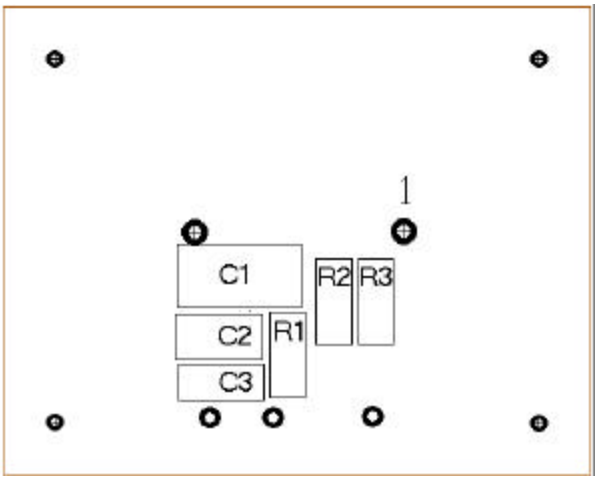
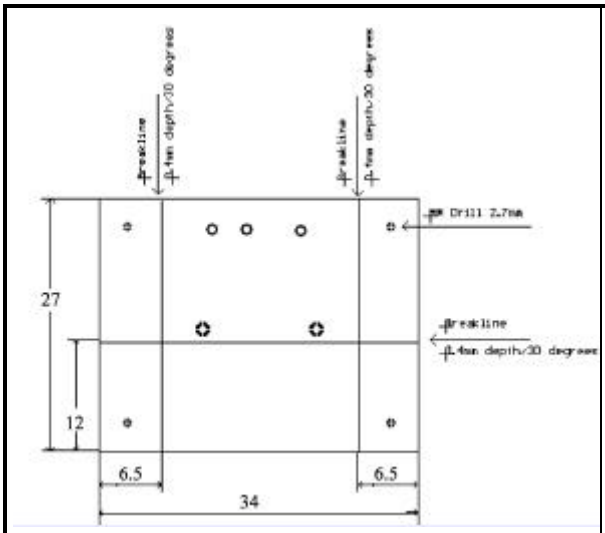
<table>
<tr>
<td> 
</td>
<td> 
</td>
</tr>
<tr>
<td>Board layout and component placement, top side
Remark: This layout is not for the 6000 series. In case of 6000E and 5000 series only the static mode switching is available (pad 9).</td>
<td>Pad assignment:
GND: 2, 3, 4, 6, 8, 10
VCC: 1
Rxd: 7
Txd: 5
SC(4000 series)
or Mode (5000 series): 9</td>
</tr>
<tr>
<td>  </td>
<td> 
</td>
</tr>
<tr>
<td>Layout and component placement, bottom side</td>
<td></td>
</tr>
</table>

Figure 8 Board layout for top-view transceivers



Board dimensions

The test board is 15 mm x 21mm in size.
In the lab setup, however, mounting holes to fix the board are also very helpful.
Therefore, we added to the test board the outer frame for easy attachment in a setup.

Breaklines are provided to break off the outer part if not used.

Figure 9 Board dimensions for top-view version

Table 1 Pin assignment and component list

Compo-nents	TFDS6x00, TFDT6x00	TFDS4x00, TFDT4x00
C1	10 µF	10 µF
C2	470 nF, X7R	470 nF, X7R
C3	6.8 µF	6.8 µF
R2, R3	14 Ω, 14 Ω	28 Ω, 28 Ω
R1	22 Ω to 47 Ω max. E-versions: (Vcc = 5V±10%): 47 Ω (Vcc = 3V): 47 Ω	22 Ω to 47 Ω max.

All SMD resistors are size 1206

In test setups under lab conditions, the resistor R1 is often not necessary.

However, it is recommended to test and optimize the system with the original application power supply under real application conditions.

The given set of components is suitable for TFDx6x00, TFDx4x00 and TFDS3000. Under lab conditions, cable lengths with twisted pairs of cables up to more than a meter can be used.

In the application, the RF emission is not negligible due to EMI problems. Therefore, the cable length should be minimized. When shielded cables are used, the higher capacitive load should be taken into account. Line drivers might be necessary for cable lengths exceeding 30 cm in length.

Table 2 Recommended Connector for twisted pair cables, pin assignment

TFDS/T 6x00/5x00	TFDS/T4x00	wire
Vcc, pin 1	Vcc, pin 1	red
TXD, pin 5	TXD, pin 5	yellow
GND: 2, 3, 4, 6, 8,10	GND: 2, 3, 4, 6, 8,10	white, orange
RXD, pin 7	RXD, pin 7	green
SD, pin 9	SC, pin 9	blue
Cable type Speedy-Twist, ITT Cannon Type: CG 1228L-XX127 AWG: 7/36 Capacity: 50pF/m	Cable type Speedy-Twist, ITT Cannon Type: CG 1228L-XX127 AWG: 7/36 Capacity: 50pF/m	Colors refer to the cable used in the demo kit.

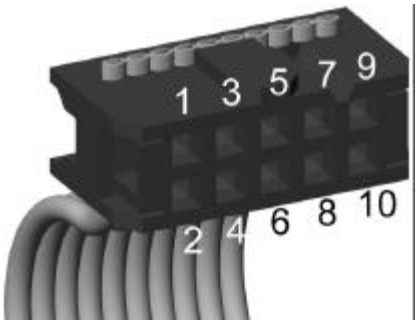
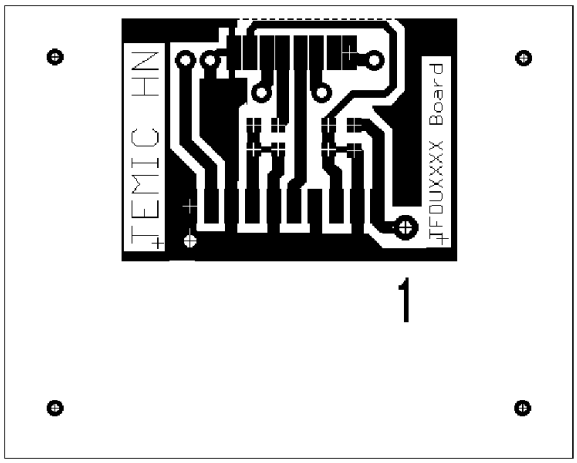


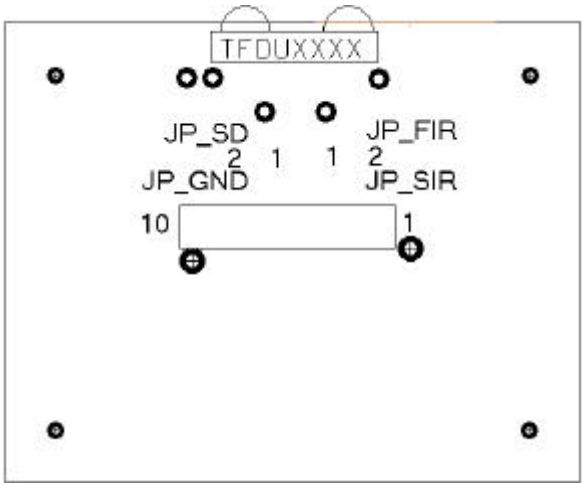
Figure 10 Twisted pair 10 pin connector

Board Layout for all Vishay Telefunken Universal Babyface Transceivers TFDUx100

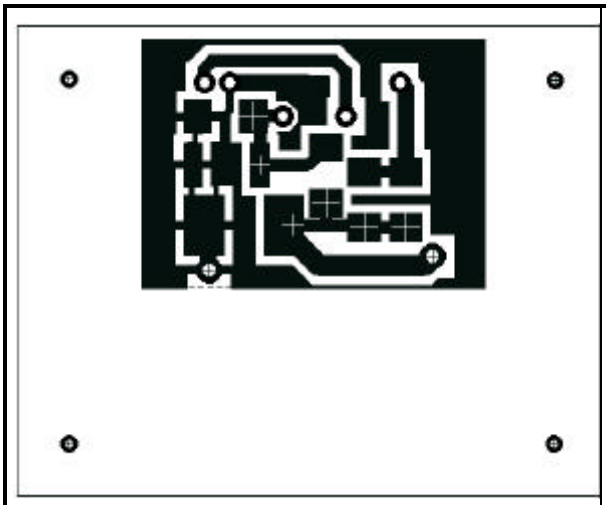
This layout is already prepared for easy use with Intel or Asus mainboards with a built-in SIR port. For the settings on the demo board, see figure 11. For the connector to be used with standard mainboards, see figure 14. In figure 15, the pin assignment for a National demo board is shown.



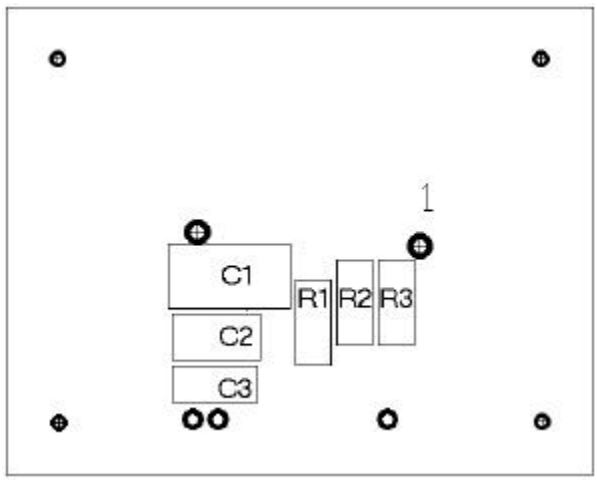
Board layout, top side



Component placement, top side

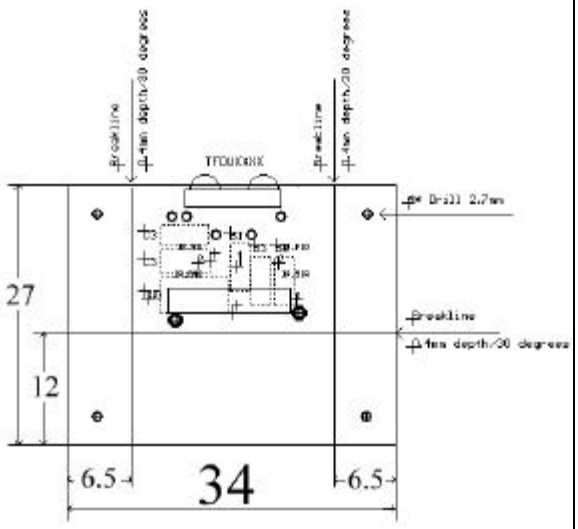


Board layout, bottom side, seen from top through the board.



Component placement, bottom side. Looking onto the bottom side

Figure 11 Universal transceiver board layout, the transceiver can be soldered for top and side-view applications.

<table>
<tr><td>Pad assignment:
GND: 2, 4, 6, 8, 10
VCC: 1
Rxd: 5
Txd: 9
SD/MODE: 7
MODE: 3</td><td colspan="2"></td></tr>
<tr><td> 
</td><td>Jumper default setting:
JP_SD open
JP_GND closed, short

JP_FIR open
JP_SIR short

For use with standard mainboard, SIR only
TFDU5100

JP_SD short
JP_GND short

JP_FIR open
JP_SIR short</td><td>For use with standard mainboard, SIR TFDU4100

JP_SD short
JP_GND short

JP_FIR open
JP_SIR open (cut the bridge!)</td></tr>
<tr><td>Board dimensions

The test board is 15 mm x 21mm in size.
In the lab setup, however, often mounting holes to fix the board are very helpful.
Therefore, we added the outer frame to the test board for easy attachment in a setup.</td><td colspan="2">Breaklines are provided to break off the outer part if not used.</td></tr>
</table>

Figure 12 Pad assignment and board dimensions

Table 3. Component List

Compo -nents	TFDU5100 TFDU6100E	TFDU4100
C1	10 µF	10 µF
C2	470 nF, X7R	470 nF, X7R
C3	6.8 µF	6.8 µF
R2, R3	14 Ω, 14 Ω	28 Ω, 28 Ω
R1	(Vcc = 5V ± 10%): 220 Ω (Vcc = 3V): 47 Ω	22 Ω to 47 Ω max.

All SMD resistors are size 1206
In test setups under lab conditions, the resistor R1 is often not necessary.

However, it is recommended to test and optimize the system with the original application power supply under real application conditions.

The given set of components is suitable for TFDx6x00, TFDx4x00 and TFDS3000. Under lab conditions, cable lengths with twisted pairs of cables up to more than a meter can be used.

In the application, the RF emission is not negligible due to EMI problems. Therefore, the cable length should be minimized. When shielded cables are used, the higher capacitive load should be taken into account. Line drivers might be necessary for cable lengths exceeding 30 cm in length.

Table 4. Recommended Connector for twisted pair cables, pin assignment

TFDU6x00(E); TFDU5100	TFDU4x00	wire
Vcc, pin 1	Vcc, pin 1	red
Mode, pin 3	SC, pin 3	orange
RXD, pin 5	RXD, pin 5	yellow
GND: 2, 4, 6, 8,10	GND: 2, 4, 6, 8,10	white
SD, pin 7	SD, pin 7	green
TXD, pin 9	TXD, pin 9	blue
Cable type Speedy-Twist, ITT Cannon Type: CG 1228L-XX127 AWG: 7/36 Capacity: 50pF/m	Cable type Speedy-Twist, ITT Cannon Type: CG 1228L-XX127 AWG: 7/36 Capacity: 50pF/m	Colors refer to the cable used in the demo kit.

Figure 13 Twisted pair 10 pin connector

TFDUxxxx demo board pin connection for ASUS / Intel-boards

Vcc, pin 1	red
Code, pin 2 open	
RXD, pin 3	yellow
GND, pin 4	green
TXD, pin 5	blue
Cable type Speedy-Twist, ITT Cannon Type: CG 1228L-XX127 AWG: 7/36 Capacity: 50pF/m	Colors refer to the cable used in the demo kit.

Figure 14 Connector for Intel mainboards, SIR support

Pin-connection DB 9 for NSC test board NSC 87108 / NSC 87338

TXD, pin 1	yellow
GND, pin 2	white/orange
RXD, pin 6	green
+V, pin 7	red
SD, pin 8 (.108), pin 4 (.338)	Blue
Cable type Speedy-Twist, ITT Cannon Type: CG 1228L-XX127 AWG: 7/36 Capacity: 50pF/m	Colors refer to the cable used in the demo kit.

Figure 15 Connector SUB DB9 for NSC I/O demo board

Transceiver Performance

Transmitter

In the following tables, the oscilloscope traces of the reference design of the baby face version at minimum and maximum operating voltage (2.7 V and 5.5 V, respectively) are given.

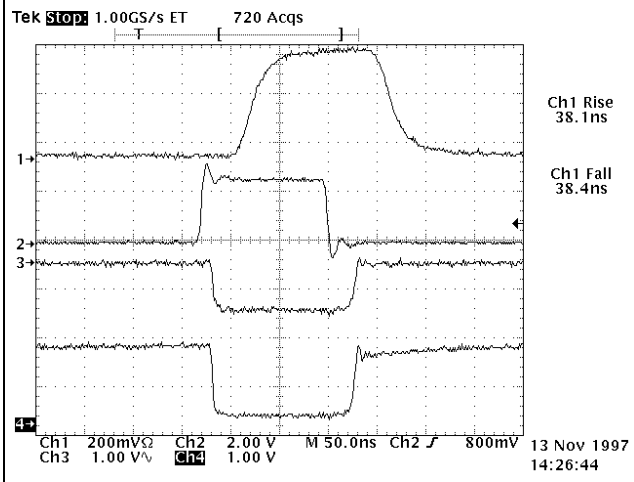


Figure 16

TFDU6100E, Vcc 2.7 V

Channel 1: Optical output signal.
The rise and fall times of the optical radiation are slightly higher than with a supply voltage of 5.5 V, but still inside the IrDA spec.

Channel 2: TxD electrical input pulse, overshoot is due to impedance mismatch.

Channel 3: Waveform of IRED current, not to scale.

Channel 4: Waveform of the cathode voltage of IRED.

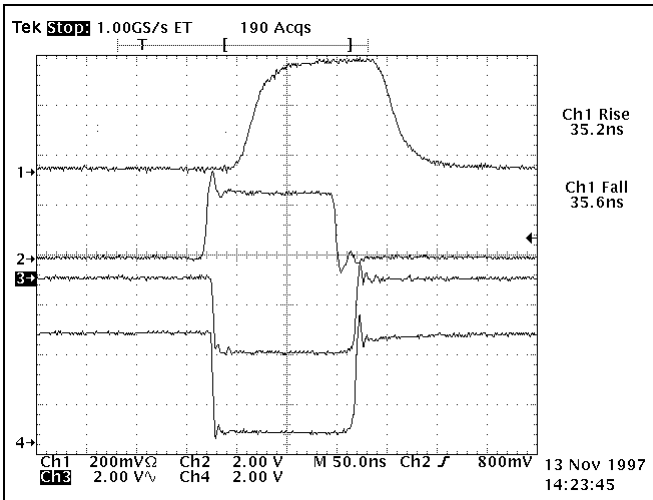


Figure 17

TFDU6100E, Vcc 5.5 V

Channel 1: Optical output signal.

Channel 2: TxD electrical input pulse, overshoot is due to impedance mismatch.

Channel 3: Waveform of IRED current, not to scale.

Channel 4: Waveform of the cathode voltage of IRED.