TFDS6000

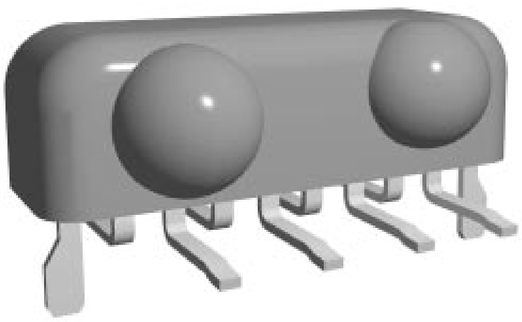
Integrated Infrared Transceiver Module IrDA

Description

The TFDS6000 is a multi-mode integrated infrared transceiver module for data communication systems. The transceiver supports all IrDA speeds up to 4 Mb/s, HP-SIR, and Sharp ASK modes. Integrated into this tiny package is a photo diode, IRED and analog IC to provide a complete solution in a single package. A current limiting resistor in series with the IRED and a V_{CC} bypass capacitor are the only external components required to implement a complete transceiver.

Features

- IrDA, HP–SIR and Sharp ASK compatible
- IrDA data rates up to 4 Mb/s
- Low profile (height = 5.6 mm max.)
- Minimum external components
- 5 V supply voltage
- Low power consumption (5 mA typ.)
- Power shut-down mode (35 µA typ.)
- Complete differential design for superior interference rejection
- Pin-compatible to TFDS3000 SIR transceiver
- Mode programming by shut-down pin



Pin description:

1: IRED cathode
2: Rx (output)
3: V_{CC} (supply voltage)
4: GND (ground)
5: NC
6: SD/Mode
7: Tx (input)
8: IRED anode
Guide pins internally connected to ground

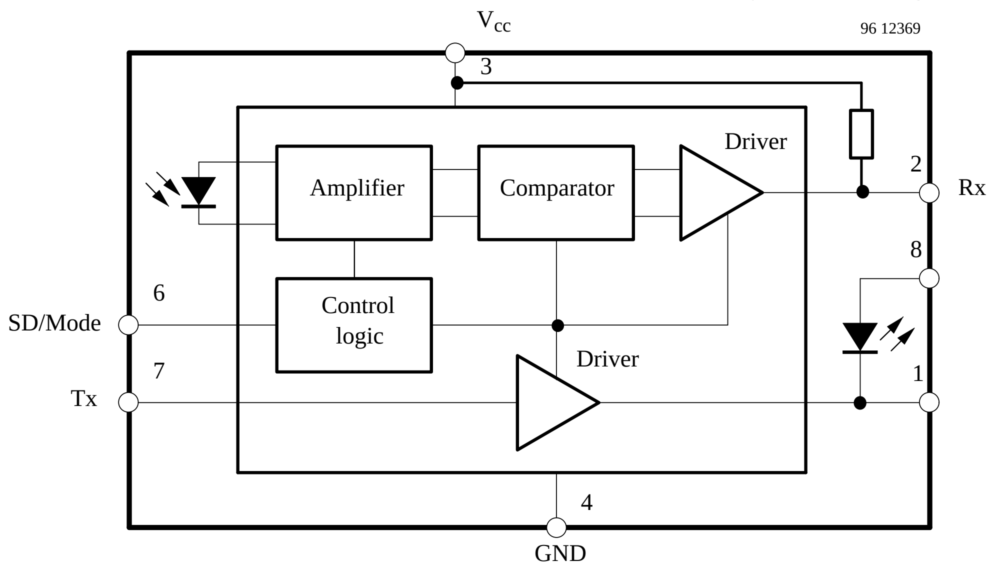


Figure 1. Block diagram

Preliminary Information

Absolute Maximum Ratings

Reference point Pin 4, unless otherwise specified

Parameter	Test Conditions	Symbol	Value	Unit
Supply voltage range		V_{CC}	–0.5 to 6	V
Input currents	All pins, except Pins 1 and 8 (see IRED current)		10	mA
Output sinking current	Pin 2		25	mA
Power dissipation, Emitter, Receiver	See figure 4	P_{tot}	200	mW
Junction temperature		T_j	125	°C
Ambient temperature range (operating)		T_{amb}	0 to 70	°C
Storage temperature range		T_{stg}	–25 to +85	°C
Soldering temperature	See figure , page 12 (TEMIC IrDA Design Guide)			°C
Average IRED current		I_{IRED}(DC)	135	mA
Repetitive pulsed IRED current	< 90 µs, t_{on} < 19% < 25%	I_{IRED}(RP)	650 550	mA mA
Peak IRED current	< 2 µs, t_{on} < 10%	I_{IRED}(PK)	1	A
IRED anode voltage		V_{IREDA}	–0.5 to V_{CC} +0.5	V
Transmitter data input voltage		V_{Txd}	–0.5 to V_{CC} +0.5	V
Receiver data output voltage		V_{Rxd}	–0.5 to V_{CC} +0.5	V

Basic Characteristics

T_{amb} = 25°C, V_{CC} = 5 V, unless otherwise specified

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Transceiver						
Supply voltage range		V_{CC}	4.5	5	5.5	V
Dynamic supply current	SD = LOW	I_{CC}	4	5	7	mA
Standby supply current	SD = HIGH	I_{SD}		35	70	µA
Operating temp. range		T_A	0		70	°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			
Input voltage LOW (Tx)		V_{IL}	0		0.8	V
Input voltage HIGH (Tx)		V_{IH}	2.0			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
Receiver (Rem.: Receiver is inactive as long as SD = HIGH)						
Rise and fall time Rx		t_r, t_f	10		35	ns
Setup time *)		t_s	200			ns
Hold time *)		t_h	200			ns
Rx pulse width	9.6 kb/s	P_w	0.8		20	µs
Rx pulse width	1.2 Mb/s	P_w	100		500	ns
Rx pulse width	4.0 Mb/s	P_w	50		165	ns
Rx pulse width	4.0 Mb/s double pulse	P_w	175		290	ns
Output delay time	< 1.2 Mb/s	t_D		1	2	µs
Latency		t_L			120	µs

*) See figure 2 “Mode switching”

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Receiver						
Min. detection threshold irradiance	9.6 kb/s to 115.2 kb/s $\alpha = \pm 15°$	E_{emin}		0.025	0.035	W/m^2
Min. detection threshold irradiance	above 115.2 kb/s $\alpha = \pm 15°$	E_{emin}		0.08	0.1	W/m^2
Max. detection threshold irradiance	$\alpha = \pm 15°$	E_{emax}	3300			W/m^2
Logic low receiver input irradiance		$E_{emaxlow}$			0.004	W/m^2
Max. dc irradiance		E_{edcmax}	400			W/m^2
Transmitter						
Output radiant intensity	Tx = HIGH, SD = LOW $R_L = 8.2\ \Omega$	I_e	100	140	200	mW/sr
Output radiant intensity	Tx = LOW or SD = HIGH $R_L = 8.2\ \Omega$	I_e			0.04	mW/sr
Output radiant intensity angle of half intensity		α		± 24		°
Peak wavelength		λ_p	850		900	nm
Rise / fall time		t_r, t_f	10		35	ns
Optical overshoot					25	%

Mode Switching

The TFDS6000 powers on in low speed mode. This mode covers speeds up to 1.15 Mb/s (e.g., IrDA-SIR, ASK).
To switch the TFDS6000 from the default state to 4.0 Mb/ s and vice versa, the following programming sequences are required.

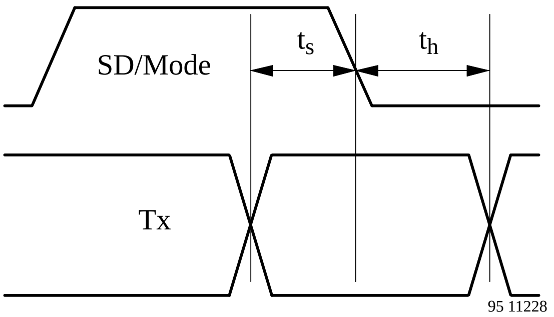


Figure 2.

Set to the 4.0 Mb/s mode

- Set SD/MODE input to logic “HIGH”.
- Set Tx input to logic “HIGH”. Wait $t_s \geq 200$ ns.
- Set SD/MODE to logic “LOW” (this negative edge latches the state of Tx which determines speed setting).
- After waiting $t_h \geq 200$ ns, Tx is to set to logic “LOW”. Tx is now enable as a normal Tx input for the 4 Mb/s.

Set to the 9.6 kb/s to 1.2 Mb/s mode

- Set SD/MODE input to logic “HIGH”.
- Set Tx input to logic “LOW”. Wait $t_s \geq 200$ ns.
- Set SD/MODE to logic “LOW” (this negative edge latches state of Tx which determines speed setting).
- Tx must be hold for $t_h \geq 200$ ns
  Tx is now enable as a normal Tx input for the SIR mode

Recommended SMD Soldering Pads for TFDS6000
Dimensions in mm

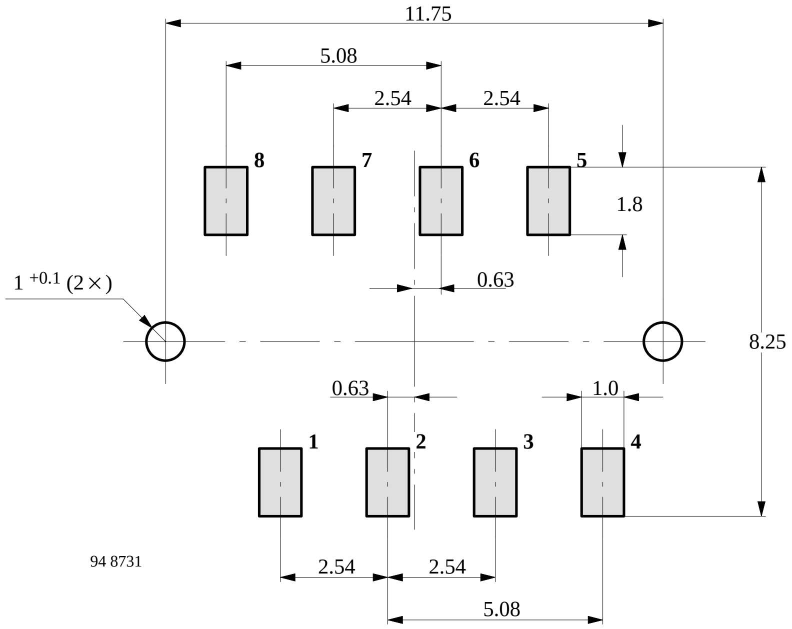


Figure 3.

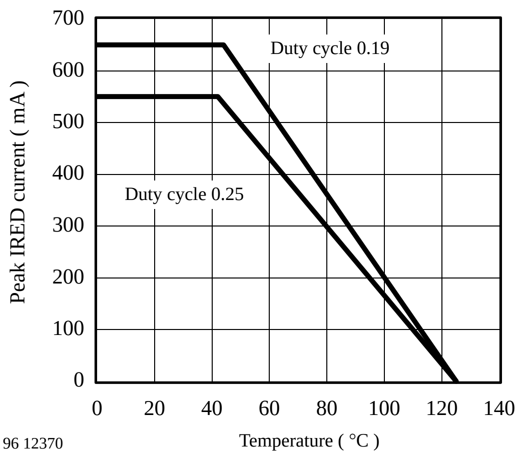


Figure 4. Current derating as a function of ambient temperature

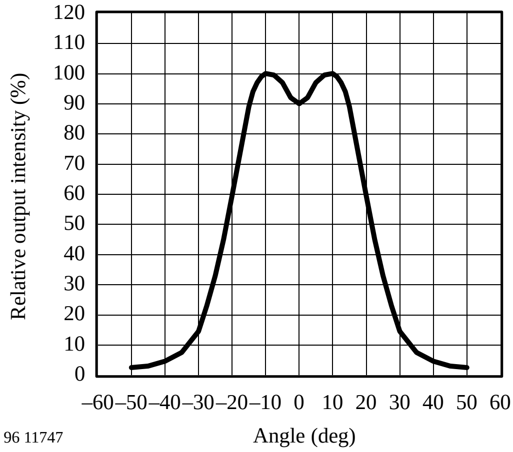


Figure 5.

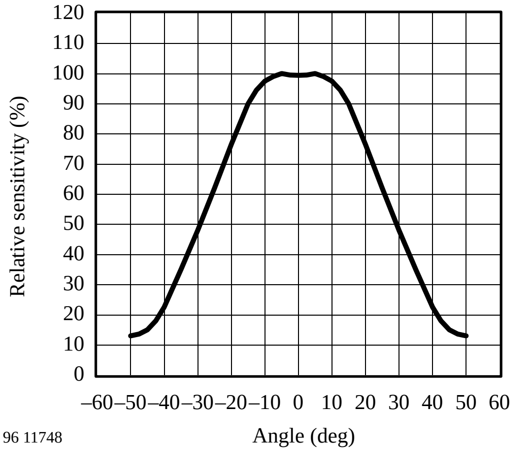


Figure 6.

Application Hints

Interfacing TFDS6000 to an ISA board by I/O controllers

In the TEMIC IrDA Design Guide (pages 14 ff) the interfacing by SMC and NSC controllers is described.

Reflow soldering

In the TEMIC IrDA Design Guide (pages 14 ff) the reflow soldering by SMC and NSC controllers is described.

Window Size in Housings

In the drawings (figure 10 of the TEMIC IrDA Design Guide), the minimum window size in relation to the distance between the window and the transceiver is described.

The designer must use a transparent material with low absorption in the IR. Manufactures and their addresses are listed in the TEMIC IrDA Design Guide (page 18).

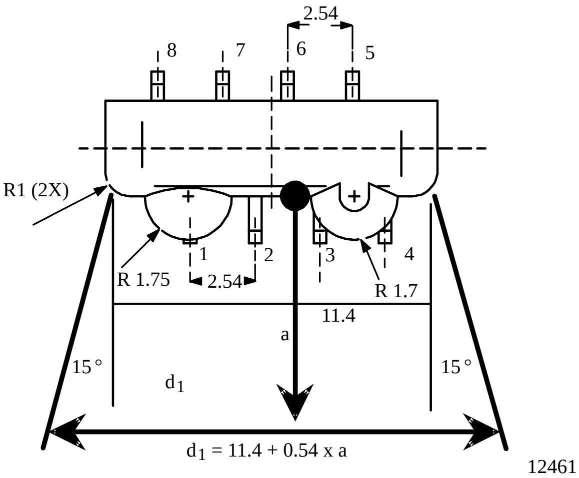


Figure 7. Optical window size in relation to the distance to TFDS3000, top view

The optical window must be a minimum size of $d_1 \times d_2$ rectangular or elliptical so as not to reduce the IrDA performance. Dimensions of d_1, d_2 and a are given in mm.

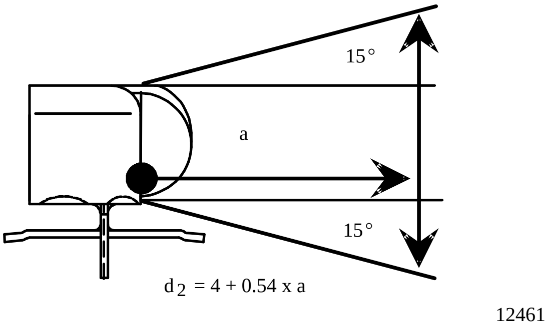


Figure 8. Optical window size in relation to the distance to TFDS3000, side view

Circuit and Board Layout Proposal

TFDS3000 / TFDS6000, Recommended Circuit Diagrams

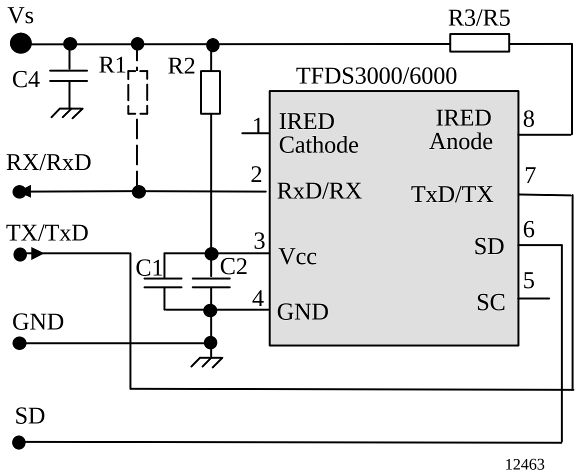


Figure 9. DC-coupled Tx/TxD input

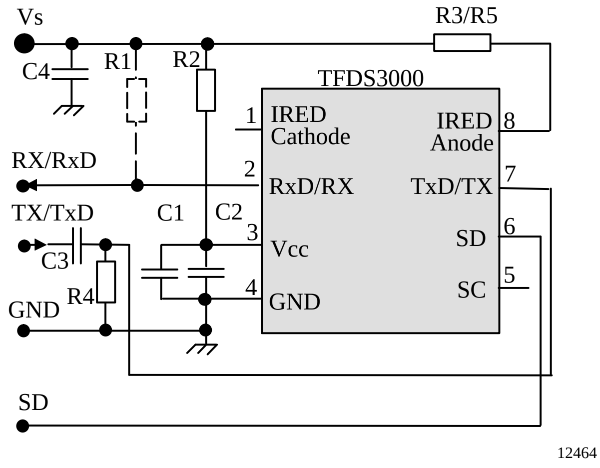


Figure 10. AC-coupled TxD input

Remarks

TFDS3000 and TFDS6000 have a compatible pin layout and therefore can be used with the same board layout.

Capacitive coupling (C3/R4-combination in layout) should only be used when necessary in the case if the input signal can be active for longer periods of time. This can happen under certain conditions connected to the older NSC or SMC Super I/Os. See e.g., the supplier's application notes. When not used, C3 is to be replaced by a short and R4 will be omitted as in the circuit diagram.

In case of TFDS6000 care should be taken that the voltage at theTx input never exceeds the specified values. A lower negative voltage at Tx than the absolute maximum value will immediately cause a latch up of the circuit. Therefore the values of R3 and C4 must be exactly adjusted to the longest applied pulse to prevent the mentioned situation by differentiating the signal at the capacitor.

R3 and R5 in parallel are used for controlling the current through the IR emitter. For increasing the output power reduce the value, for reducing the output power increase the value as described in the TEMIC IrDA Design Guide. A diagram of the typical dependence of the intensity Ie as a function of the current control resistor is shown in figure 11.

The load resistor R1 is optional for use with TFDS300 when longer cables must be driven. Internally RxD of TFDS3000 is connected to Vcc by a 20 kΩ load. TFDS6000 needs no external load at the output.

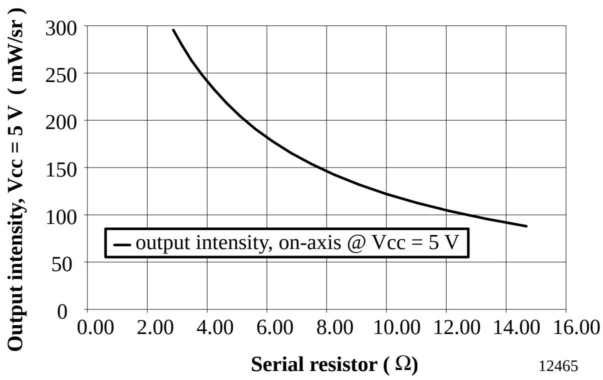


Figure 11.

Power supply

C1 and C2 are dependent on the quality of the supply voltage. Beside the shown values a combination of 6.8 µF with 100 nF will work. However, this capacitance is strongly depending on the power supply and injected noise.

When connecting the described circuit to the power supply unit low impedance wiring is absolutely necessary. Use 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 is designed to be connected by ribbon cable and a connector to a mainboard. We recommend to use twisted pair cables. The layout shows a pad layout to attache the twisted pairs correctly.

For easy use we added the mounting holes to the board. When a smaller configuration without mounting holes is preferred break off these parts at the breaking lines.

The boards can be supplied by TEMIC's Opto application division through the sales and marketing force.

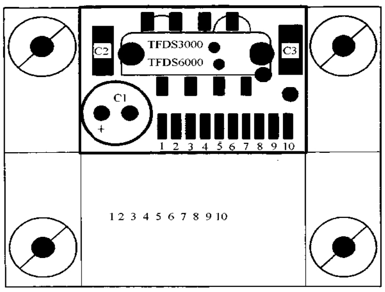


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Figure 12. Component placement, top side

Pad assignment:

GND	1, 3, 5, 6, 7, 9
VCC	10
Rx/RxD	4
Tx/TxD	8
SD/MODE:	2

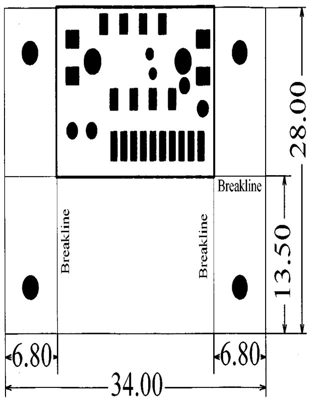

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Figure 13. Solder stop mask

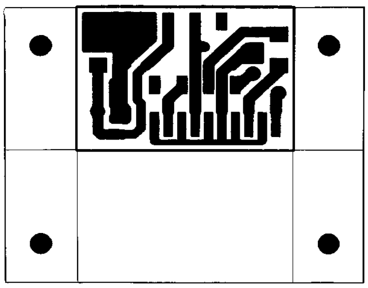

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Figure 14. First layer

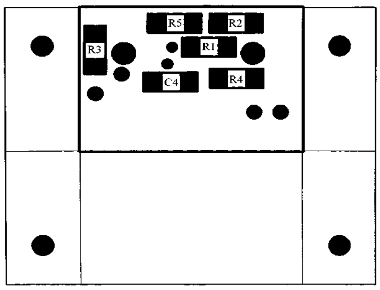

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Figure 15. Component placement, bottom side

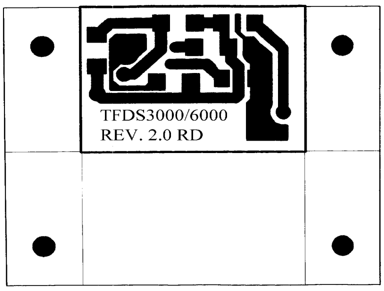

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Figure 16. Second layer

Preliminary Information

Pin Assignment

Pin	TFDS3000/6000
1	IRED Cathode
2	Rxd/RX (Output)
3	VCC (Supply Voltage)
4	Ground
5	SC
6	SD
7	Txd/TX (Input)
8	IRED Anode

Component List

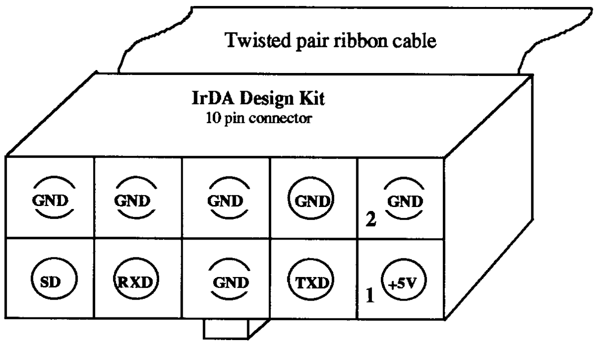
Components	TFDS3000	TFDS6000
C1	6,8 F	6,8 F
C2	220 nF	220 nF
C3 *)	220 nF or short	short
C4	100 nF	100 nF
R1	2.2 k optional	
R2	100	50
R3//R5	10 / 10	2,2
R4 *)	2.2 k or open	open

*) DC coupling recommended. Adapt the time constant C3 R4 to the longest possible pulse to avoid negative signals at the input, see “Absolute Maximum Ratings” in the data sheets.

Recommended Connector for Twisted Pair Cables, Pin aAssignment

Vcc	Pin 1	Red
TXD	Pin3	Orange
GND	Pins 2, 4, 5, 6, 8, 10	Light brown,yellow
RXD	Pin 7	Green
SD	Pin 9	Blue

Colors refer to the cable used in the demo kit.



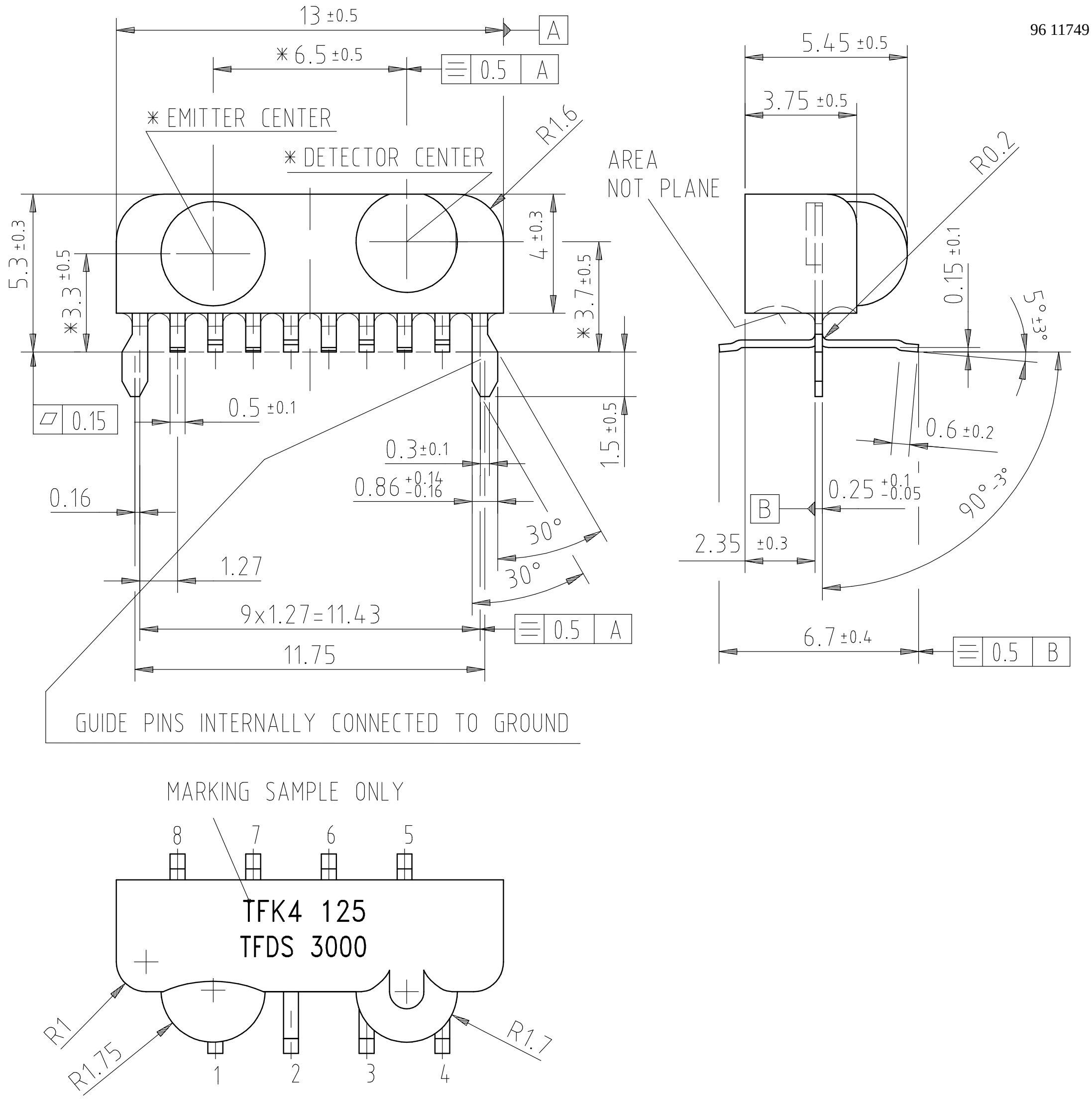
Pin Assignment and Description

Pin	Pin Name	Description	I/O	Active
1	IRED cathode	Connected to internal IRED cathode and driver transistor respectively.		
2	Rx	Received data, push-pull CMOS driver output capable of driving a standard CMOS or TTL load. No external pull-up or pull-down resistor is required.	O	LOW
3	V_{CC}	Supply voltage, 5 V. Use low noise power supply. RC lowpass is strongly recommended (see application circuit). Connection to the power supply by low impedance wiring!		
4	GND	Ground. Connection to the power supply and system ground by low impedance wiring!		
5	NC	No connection		
6	SD/Mode	Standby/ speed programming mode. The TFDS6000 powers on in the lower frequent mode to operate up to 1.15 Mb/s. Figure 2 shows how to set TFDS6000 to the 4 Mb/s mode. The optical output is disabled when SD is active and is not enabled until the next rising edge of Tx.	I	HIGH
7	Tx	Transmit data, can be disabled by setting SD/MODE pin HIGH.	I	HIGH
8	IRED anode	Internally connected to IRED anode		
–	2 guide pins	Internally connected to ground		

Equivalent Circuits of Inputs and Outputs

Pin	Description
Rx	For a 2.2 kΩ pull-up @ 5 V, the current drawn by Rx is 2.15 mA.
SD	Pull-down of 200 kΩ, and equivalent capacitive loading of 2 pF (1.5 pF the pad, and 0.5 pF for on-chip logic).
Tx	Pull-down of 100 kΩ, and equivalent capacitive loading of 2 pF (1.5 pF the pad, and 0.5 pF for on-chip logic).
	These numbers are nominal values, and a variation of ± 20% can be expected.

Dimensions in mm



Preliminary Information

Ozone Depleting Substances Policy Statement

It is the policy of **TEMIC TELEFUNKEN microelectronic 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.

TEMIC TELEFUNKEN microelectronic GmbH semiconductor division 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.

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

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