Integrated Low-Profile Transceiver

Description

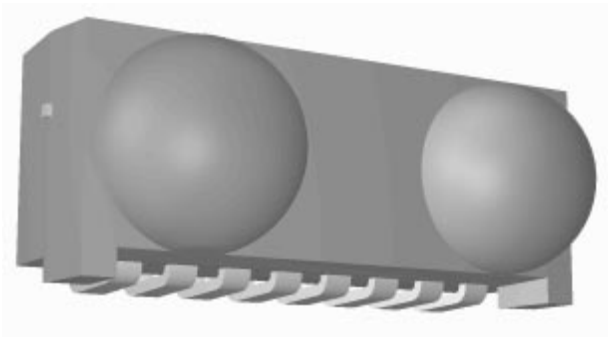
The miniaturized TFDU4100 is an ideal transceiver for applications in telecommunications such as mobile phones and pagers. The infrared transceiver is compatible to the IRDA standard data rate of 115 kBit/s. An internal AGC (**A**utomatic **G**ain **C**ontrol) ensures proper operation under EMI conditions.

The internal IRED driver can be connected by the external current-control resistor to an independent unregulated power supply. This will add more flexibility in circuit design and efficient serial drive capability for external IREDs for high-power applications.

A shut down can be realized by turning off only the power supply, V_{CC}, for the driver IC.

Features

- Package dimension:
  L 9.7 mm x W 4.7 mm x H 4.0 mm
- Compatible to IRDA standard
- SMD side and top view solderability
- Low power consumption
- Wide supply voltage range (2.7 to 5.5 V)
- Few external components
- Open-collector IRED driver
- AGC for EMI immunity



Pin description:

1: IRED anode
2: IRED cathode
3: Txd (input)
4: Rxd (outout)
5: NC
6: V_{CC}
7: SC (sensitivity control)
8: Ground

Block Diagram

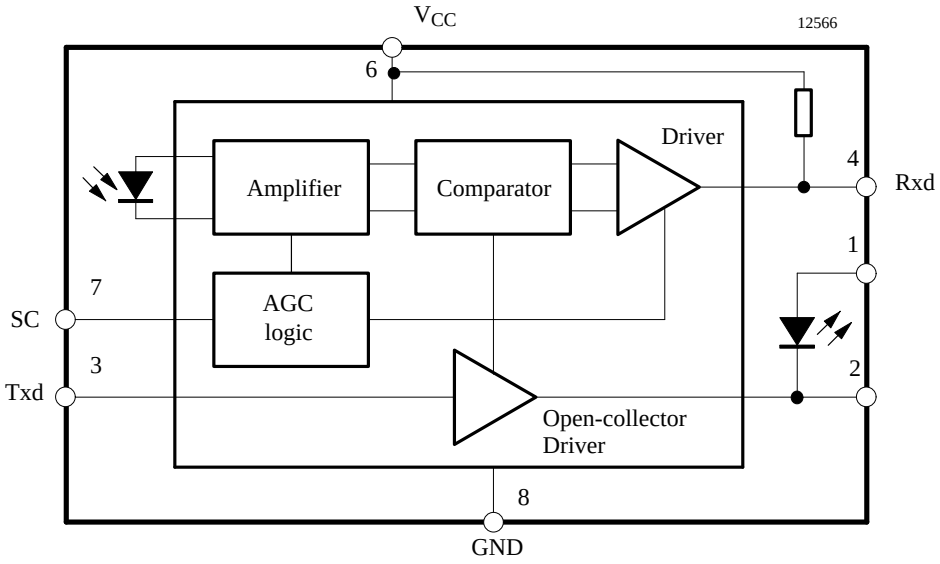


Figure 1. Block diagram

Absolute Maximum Ratings

Reference point Pin 8, unless otherwise specified

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Supply voltage range		V_{CC}	–0.5		6	V
Voltage range of IRED drive output	Pin 1, Txd ‘‘LOW”		–0.5		6	V
Input current	All pins except 1 and 2, see IRED current				10	mA
Output sink current					25	mA
Power dissipation	See derating curve, page 7	P_{tot}			200	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	t = 20 s @215°C See TEMIC IrDA Design Guide			215	230	°C
Average IRED current		I_{IRED}(DC)			100	mA
Rep. pulsed IRED current	< 90 µs, t_{on} < 20%	I_{IRED}(RP)			500	mA
Peak IRED current	< 2 µs, t_{on} < 10%	I_{IRED}(PK)			1	A
IRED anode voltage		$V_{IRED,A}$	–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

Optoelectronic Characteristics

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

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Transceiver						
Supported data rates	Baseband IrDA SIR mode		2.4		115.2	kBit/s
Supply voltage range	Reduced function down to 2.5 V	V_{CC}	2.7	5	5.5	V
Supply current	V_{CC} = 5 V	I_S		1.3	2.5	mA
Supply current	V_{CC} = 3 V	I_S		1.0	1.5	mA
Leakage current of IR emitter, Pin 8	V_{CC}: Off, Txd: ‘‘LOW” V_{CC2} = 6 V, T = 25 to 85°C See recommended application circuit page 5			0.005	0.5	µA
Transceiver “power on” settling time	Time from switching on V_{CC} to establish specified operation				50	µs
Receiver						
Min. detection threshold irradiance, SC = ‘‘LOW”	$\alpha = \pm 15°$ SIR mode *)	$E_{e, min}$		0.020	0.035	W/m^2
Min. detection threshold irradiance, SC = ‘‘HIGH”	$\alpha = \pm 15°$ SIR mode *)	$E_{e, min}$	0.006	0.010	0.015	W/m^2
Max. detection threshold irradince	$\alpha = \pm 90°$, V_{CC} = 5 V, SIR mode *)	$E_{e, max}$	3300	5000		W/m^2
Max. detection threshold irradiance	$\alpha = \pm 90°$, V_{CC} = 3 V, SIR mode *)	$E_{e, max}$	8000	15000		W/m^2
Logic LOW receiver input irradiance SC = ‘‘HIGH” or “LOW”		$E_{e, max, low}$			0.004	W/m^2
Output voltage Rxd	Active C = 15 pF, R = 2.2 kΩ	V_{OL}		0.5	0.8	V
Output voltage Rxd	Non active C = 15 pF, R = 2.2 kΩ	V_{OH}	V_{CC}–0.5			V
Output current, V_{OL} < 0.8 V				4		mA
Rise time @load: C = 15 pF, R = 2.2 kΩ			20		200	ns
Fall time @load: C = 15 pF, R = 2.2 kΩ			20		200	ns

*) BER = 10^{-8} (IrDA specification)

Optoelectronic Characteristics (continued)

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

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Receiver (continued)						
Rxd signal electrical output pulse width	2.4 kBit/s, input pulse length 1.41 µs to 3/16 of bit length		1.41		20	µs
Rxd signal electrical output pulse width	115.2 kBit/s, input pulse length 1.41 µs to 3/16 of bit length		1.41		8	µs
Output delay time (Rxd)	Output level = 0.5 x V_{CC} @E_e = 0.040 W/m^2 Max. delay of leading edge of output signal related to leading edge of optical input signal			1	2	µs
Jitter, leading edge of output signal	Over a period of 10 bit, 115.2 kBd				2	µs
Output delay time (Rxd)	Output level = 0.5 x V_{CC} Max. delay of trailing edge of output signal related to trailing edge of optical input signal				6.5	µs
Latency	Recovery from last transmitted pulse to 1.1 × threshold sensitivity	t_L		100	800	µs
Transmitter						
Driver current IRED	Current limiting resistor in series to IRED: @ 5 V & R_S = 8.2 Ω, I_d can be adjusted by variation of R_S, see application hint	I_d		0.3	0.5	A
Logic LOW transmitter input voltage		V_{IL}(Txd)	0		0.8	V_{CC}
Logic HIGH transmitter input voltage	Max. input current I_{IN} < 100 µA	V_{IH}(txd)	2.4		V_{CC}	

Optoelectronic Characteristics (continued)

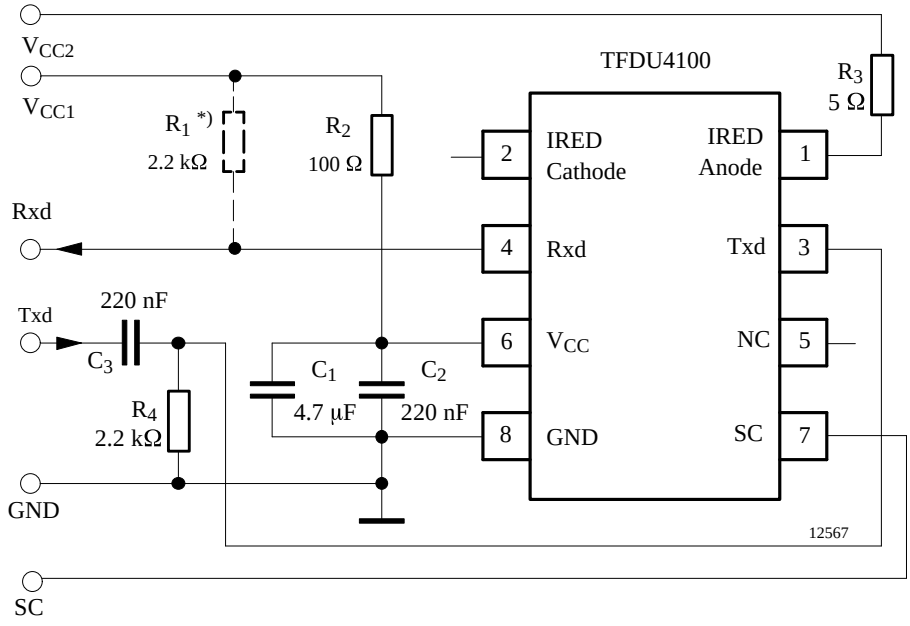
T_{amb} = 25°C, V_{CC} = 5 V unless otherwise specified

Parameters	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Transmitter (continued)						
Output radiant intensity, $\alpha = \pm 15°$	Current limiting resistor in series to IRED: R_S = 8.2 Ω, @ V_{CC2} = 5 V In agreement with prospective future eye safety limits of IEC825		45	150	200	mW/sr
Angle of half intensity		α		± 24		°
Peak wavelength of emission		λ_p	850		900	nm
Halfwidth of emission spectrum				60		nm
Optical rise/ fall time	115.2 kHz square wave signal (1:1)			200	600	ns
Output radiant intensity	Logic LOW level				0.04	µW/sr
Overshoot, optical					25	%
Rising edge, peak-to-peak jitter	Over a period of 10 bits, independent from information content	t_j			0.2	µs

Applications

For more application circuits, see IrDA Design Guide and TOIM3xxx Design Hints.

Recommended Application Circuit



*) R_1 not necessary in on-board applications

The Txd input should be DC-coupled. R4 and C3 are only necessary when the input signal is active for longer periods. This might occur under certain conditions, for example, if the TFDU4100 is connected to the NSC or SMC Super I/Os™ (see the National Semiconductors application note).

The load resistor R1 is optional when longer cables must be driven. Internally, RxD is connected to V_{CC} by a 20 kΩ load.

C1 and C2 are dependent on the quality of the supply voltage, V_{CC}. A combination of 6.8 µF with 100 nF will work in most cases.

The power supply for V_{CC1} has to source only about 1 mA typically.

R3 is used for controlling the current through the IR emitter. To increase the output power, the value of R3 has to be reduced. To reduce the output power, the value of R3 has to be increased as described in TEMIC's IrDA Design Guide. The upper drive current limitation is depending on the duty cycle and is given by the absolute maximum ratings (see page 2).

Shut Down

The TFDU4100 can be shut off very efficiently by keeping the IRED connected to the power supply V_{CC2}, but switching V_{CC1} off. Therefore, a special shut down is not needed.

The V_{CC2} source can be an unregulated power supply. The voltage at Pin 1 is limited to maximum 6 V. The settling time after switching V_{CC1} on is less than 50 µs.

The TOIM3232 interface circuit is designed for this application. The V_{CC}-SD, S0 or S1 outputs can be used to power the TFDU4100 with a supply current.

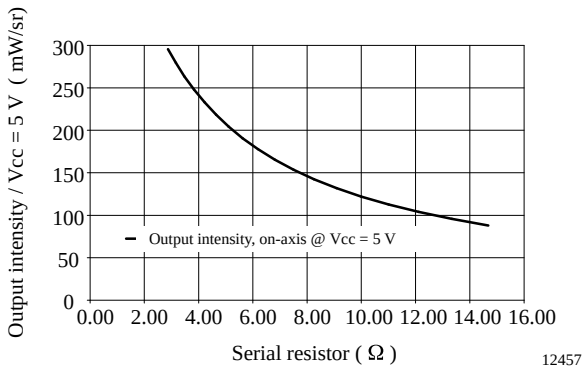


Figure 2.

Latency

The receiver is in specified conditions after the defined latency. In a UART-related application, the receiver buffer of the UART must be cleared after 100 µs typically. After receiveing the last bit and before starting the transmission, the transceiver has therfore to wait at least for the specified amount of time (latency). This is to ensure that the corresponding receiver is in a defined state.

Pin Assignment

Pin	Pin Name	Description	I/O	Active
1	IRED anode	IRED anode, to be connected to V_{CC2} by a current limiting resistor		
2	IRED cathode	IRED cathode, internally connected to driver transistor		
3	Txd	Transmit data	I	HIGH
4	Rxd	Receive data	O	LOW
5	NC	Not connected		
6	V_{CC}	Supply voltage		
7	SC	Sensitivity control	I	HIGH
8	GND	Ground		

Recommended SMD Soldering Pad Layout for TFDU4100
Dimensions in mm

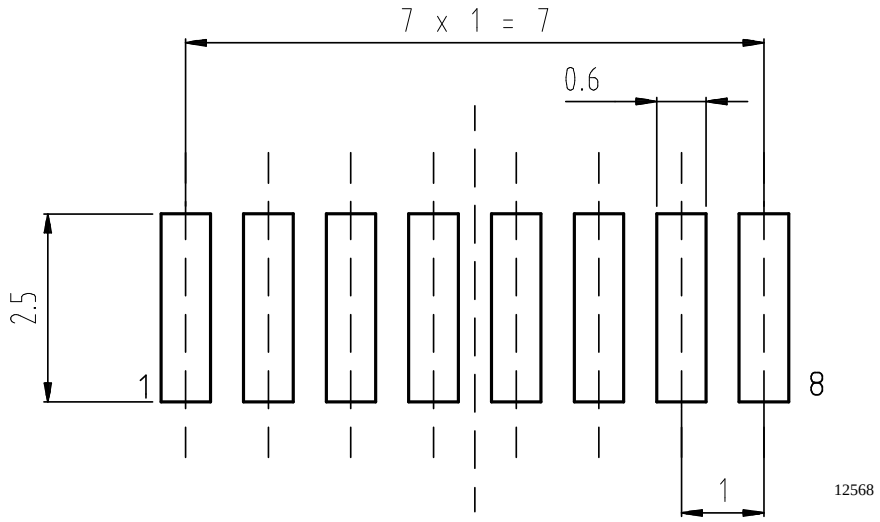


Figure 3.

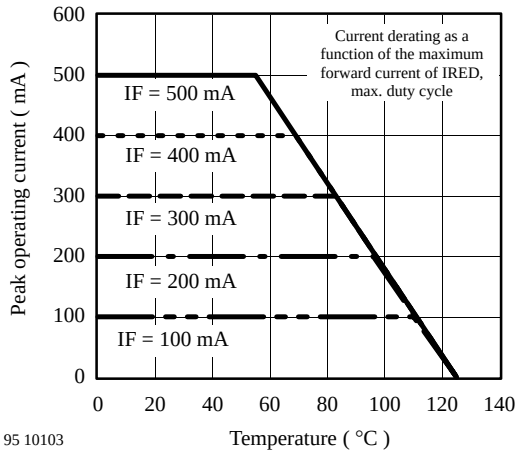


Figure 4. Current derating as a function of ambient temperature, duty cycle 20%

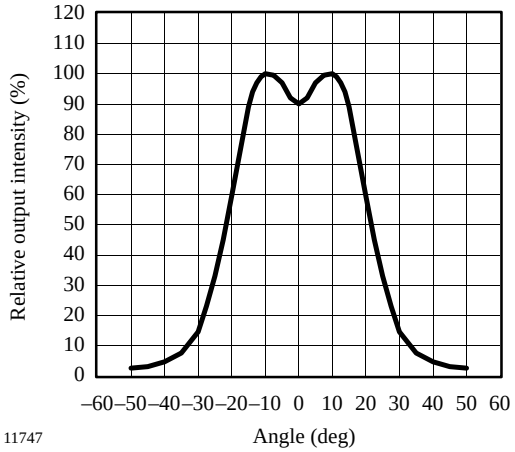


Figure 5. Angular emission characteristic

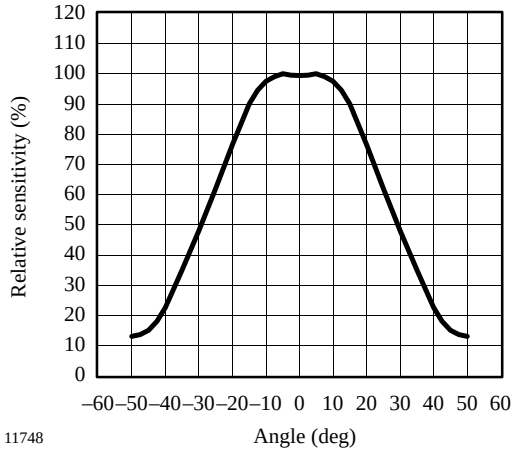
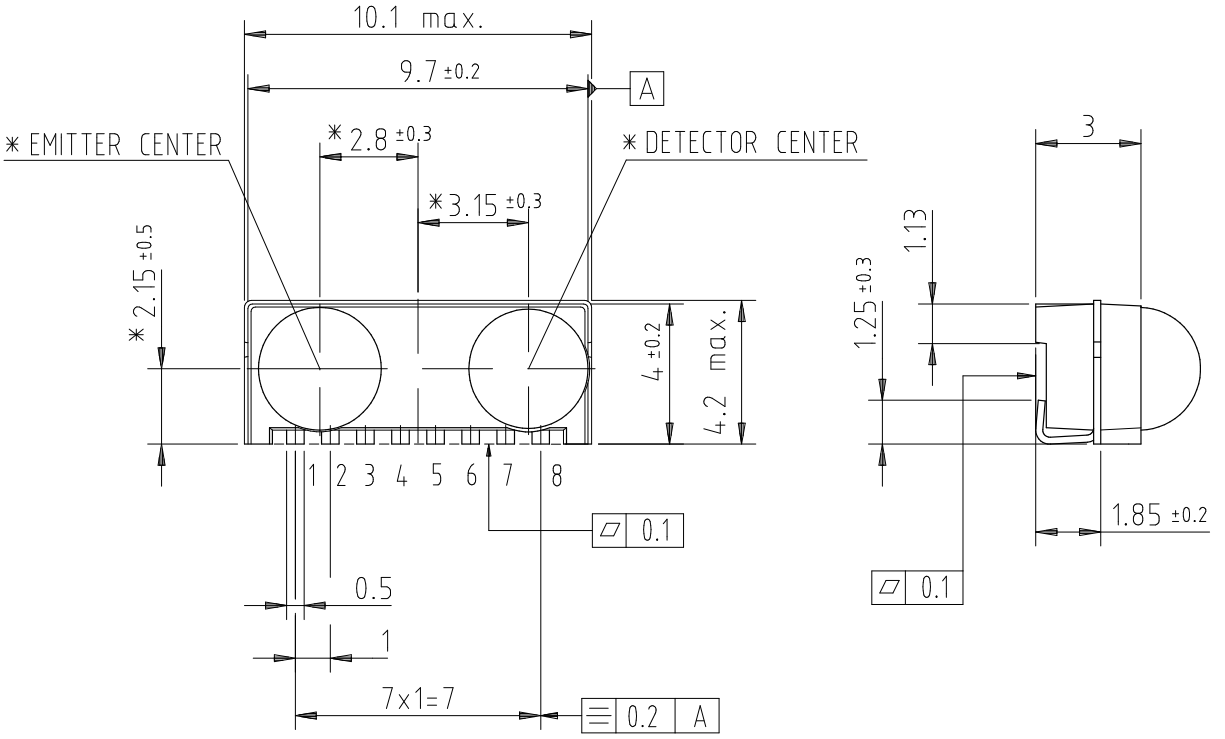
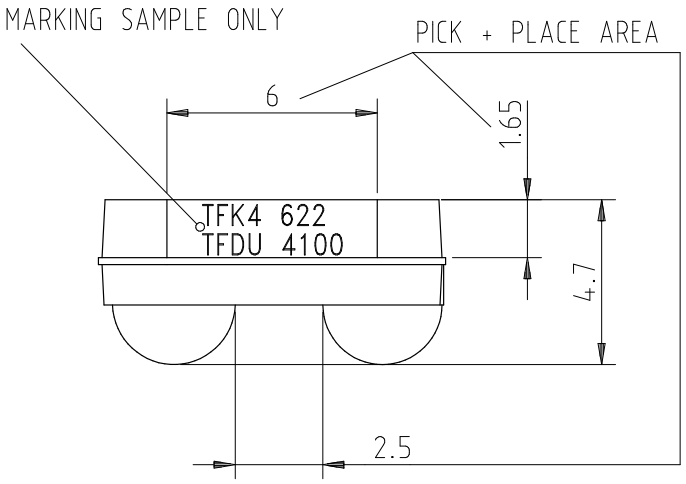


Figure 6. Angular receiving characteristic

Mechanical Dimensions





PIN	FUNCTION
8	Ground
7	SC (Sensitivity control)
6	Vcc
5	N.C.
4	RxD (Output)
3	TxD (Input)
2	IRED Cathode
1	IRED Anode

technical drawings according to DIN specifications

12249

Ozone Depleting Substances Policy Statement

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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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