

Infrared IrDA Integrated Interface Circuits

ULC-Technology: High-performance gate array package using dual metal layer CMOS technology, featuring sub-micronic channel length (0.8 μm)

Features

Type	Description
TOIM3000	<ul style="list-style-type: none"> • Pulse shaping function (shortening and stretching) used in infrared IrDA standard applic. • Directly interfaces the infrared transceiver TFDS3000^{*)} to a UART • 3 V and 5 V operation with low operating current • SO16 package
TOIM3232	<ul style="list-style-type: none"> • Pulse shaping function (shortening and stretching) used in infrared IrDA standard applic. • Directly interfaces the infrared transceiver TFDS3000^{*)} to an RS232 port • Programmable baud clock generator (600 ~ 115 kHz), 14 baud rates • 3 V and 5 V operation with low operating current • SO16 package

^{*)} TFDS3000 is an infrared IrDA transceiver made by TEMIC

Function

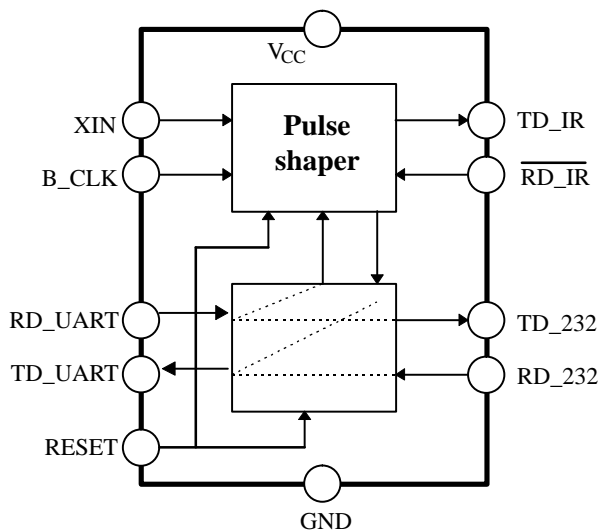
The TOIM3xxx series ICs provide proper timing for the front end infrared transceiver TFDS3000, as specified by the IrDA standard. In the transmit mode, the TOIM3xxx provides IrDA-compatible electrical pulses to the infrared transceiver TFDS3000 on logic LOW electrical input. In the receive mode, the TOIM3xxx stretches received infrared pulses to the proper bit width at the operating bit rate. The IrDA bit rate varies from 2.4 to 115.2 kbit/s.

- For the UART interface, the TOIM3000 accepts the 1.8432 MHz clock input as the fast clock and the baud

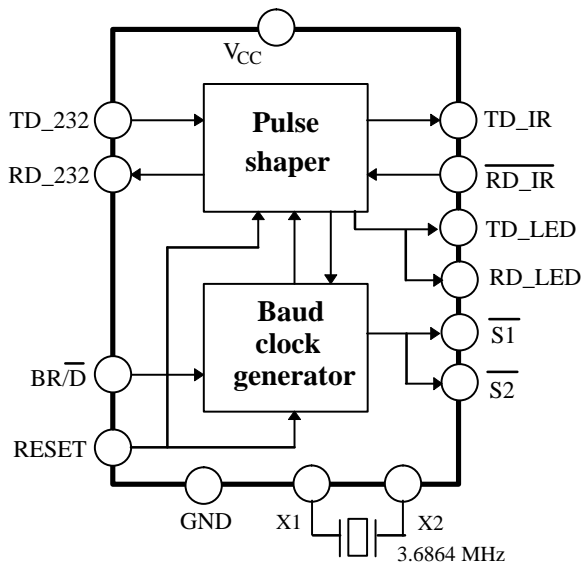
clock output from the UART to do the pulse stretching and shortening. The baud clock is 16 times the baud rate. The output pulses are fixed at 1.617 μs .

- For the RS232 interface, the TOIM3232 accepts an external crystal clock 3.6864 MHz for its pulse stretching and shortening. The TOIM3232 is programmable to operate from 600 bit/s to 115.2 kbit/s by the communication software through the RS232 port. Output pulses are software-programmable as either 1.617 μs or 3/16 of bit time.

Block Diagrams



TOIM3000



TOIM3232

Pin Description TOIM3000

Pin	Symbol	Function	I/Q	Active
1	RESET	Resets all internal registers. Initially must be HIGH to reset internal registers. When LOW, the TOIM3000 connects the UART with IrDA transceiver. Data received from the UART transmits out through infrared transmitter. Data received from the infrared receiver is routed to the UART. When HIGH, the TOIM3000 connects the UART with RS232 port. Data received from the UART transmits out through the RS232 port, while data received from the RS232 port is routed to the UART.	I	
2	RD_UART	Received data to the UART	O	LOW
3	TD_UART	Data fom the UART to be transmitted	I	LOW
4	B_CLK	16 times baud rate clock, input from the UART (Baudout)	I	
5	XIN	Oscillator input, 1.8432 MHz clock (to be connected to Xout pin of the UART)	I	
6	NC	No connection		
7	NC	No connection		
8	GND	Ground in common with the UART and RS232 port		
9	S0	Must be connected to GND		
10	S1	Must be connected to GND for output pulse length of 1.617 μ s connected to V _{CC} for pulse length of 3/16 of bit *)		
11	TD_232	Data input from the RS232 port, TXD pin	I	LOW
12	RD_232	Data output to the RS232 port, RXD pin	O	LOW
13	NC	No connection		
14	TD_IR	Data output to infrared transmitter TFDS3000	O	HIGH
15	RD_IR	Data receive input from the infrared transmitter TFDS3000	I	LOW
16	V _{CC}	Supply voltage		

*) The use of a pulse length of 3/16 of bit duration is not recommended when both clocks, Xout and Baudout, of the UART are available

Pin Description TOIM3232

Pin	Symbol	Function	I/Q	Active
1	RESET	Resets all internal registers. Initially must be HIGH ("1") to reset internal registers. When HIGH, the TOIM3232 sets the IrDA default bit rate of 9600, sets pulse width to 1.617 μ s. Then the TOIM3232 enters the power-saving mode. When RESET turns to LOW, the TOIM3232 exits power-saving mode, and sets the baud rate and 1.617 μ s pulse width mode. In the application, the RESET pin can be controlled by either the RTS or DTR line through RS232 level converter.	I	HIGH
2	BR/D	Baud Rate control / Data When BR/D = 0, Rx_232 data is transmitted to the IrDA transmitter pin TD_IR, while RD_IR is routed to the transmitter pin TD_232. When BR/D = 1, data received from the RS232 port is interpreted as the control word. The control word programs the baud rate and pulse width of TD_IR signal. The new baud rate and pulse width will be effective as soon as BR/D returns to LOW.	I	
3	RD_232	Data output of stretched signal to the RS232 port (using level converter); received signal	O	HIGH
4	TD_232	Data input from the RS232 port (passing the level converter); signal to be transmitted	I	HIGH
5	VCC_SD	V _{CC} shut-down output function. This pin can be used to shut down a transceiver (e.g. TFDS3000). Output polarity: Inverted RESET input.	O	LOW
6	X1	Crystal input clock 3.6864 MHz	I	
7	X2	Crystal input clock	I	
8	GND	Ground in common with the RS232 port and IrDA transceiver ground		
9	TD_LED	Transmit LED indicator driver. Use 270 Ω current limiting resistor in series to LED to connect to V _{CC} (V _{CC} = 5 V).	O	LOW
10	RD_LED	Receive LED indicator driver. Use 270 Ω current limiting resistor in series to LED to connect to V _{CC} (V _{CC} = 5 V).	O	LOW
11	NC	No connection		
12	S1	User-programmable bit. Can be used to turn a front end infrared transceiver ON/OFF (e.g. an infrared module at the adapter front).	O	LOW
13	S2	User-programmable bit. Can be used to turn a front end infrared transceiver ON/OFF (e.g. an infrared module at the adapter back).	O	LOW
14	TD_IR	Data output of shortened signal to the infrared transceiver TFDS3000	O	HIGH
15	RD_IR	Data input from the infrared transceiver TFDS3000	I	LOW
16	V _{CC}	Supply voltage	I	

Application

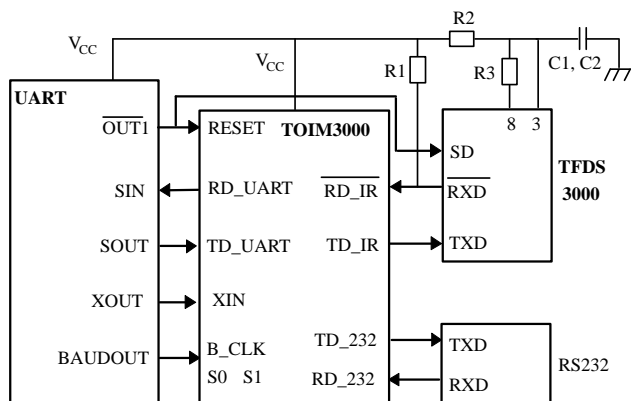


Figure 1. TOIM3000 – UART interface (built-in infrared port)

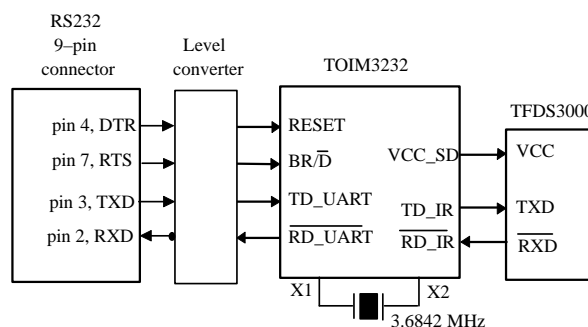


Figure 2. TOIM3232 – RS232 port interface (external infrared adapter)

Figure 1 shows a typical example of a UART interface. As shown, XIN accepts the 1.8432 MHz input clock, and B_CLK accepts the 16 times baud rate clock.

Set S1 = S0 = LOW (“0”). When RESET = 0, the TOIM3000 communicates with the infrared transceiver TFDS3000. On the other hand, whenever RESET = 1, the TOIM3000 communicates with the RS232 port.

R1 = 2.2 kΩ optional (only necessary when \overline{RXD} – $\overline{RD_IR}$ line is capacitive loaded).

R2 = 100 Ω, R3 = 10 Ω, C1 = 6.8 μF and C2 = 0.1 μF. C1 and C2 are in parallel (V_{CC} = 5 V, in case of 3 V supply, value of R3 should be reduced, see Design Guide).

Single clock operation

TOIM3000 can be operated with only a single clock. In this case, B_CLK and XIN are tight together and connected to the Baudout pin of the UART. The pulse width is then shortened to 3/16 of the bit length and noise filtering is

deactivated. S1 is to be connected to V_{CC} and S0 to GND. Figure 2 shows a typical example of an RS232 port interface. The TOIM3232 connects to an RS232 level converter on one side, and an infrared transceiver on the other. Software can be written to program the TOIM3232 baud-rate generator. When BR/D = 0, the TOIM3232 interprets RD_232 data as data transmitted to the TFDS3000. On the other hand, whenever BR/D = 1, the TOIM3232 interprets RD_232 as the control word. The baud rate can be programmed to operate from 600 bit/s to 115 kbit/s. As RS232 level converter, EIA232 or MAX232 or equivalent should be used.

The external resistors and capacitors needed are shown in figure 1. Please also refer to figure 1 for the recommended power supply filter and pull-up resistors.

The output pulse length can be programmed, see chapter “Operation Description”. It is strongly recommended to use 1.617 μs output pulses to save battery power.

Absolute Maximum Ratings

Parameter	Symbol	Min.	Typ.	Max.	Unit	Notes
Supply voltage	V_{CC}	-0.5		7	V	
Input/ output voltage		-0.5		$V_{CC} + 0.5$	V	All pins
Output sinking current	I_{out}	8			mA	All pins
Junction temperature	T_j			125	°C	
Ambient temperature (operating)	T_{amb}	0		70	°C	
Storage temperature	T_{stg}	-25		85	°C	
Soldering temperature	T_{sldr}		215	230	°C	t = 20 s @ 215°C

DC Characteristics

Specified at $V_{CC} = 5\text{ V} \pm 10\%$ (**), operating temperature 0 to 70°C

Parameter	Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Input HIGH voltage		V_{IH}	2.2			V
Input LOW voltage		V_{IL}			0.8	V
Schmitt trigger Positive threshold		V_{T+}	1.1			V
Negative threshold		V_{T-}			1.4	V
Input leakage No pull-up/ down	$V_{IN} = V_{DD}$ or GND	I_L		±1	±5	µA
Output HIGH voltage	$I_{OH} = -3.2\text{ mA}$	V_{OH}	2.4			V
Output LOW voltage	$I_{OL} = +3.2\text{ mA}$	V_{OL}			0.4	V
Current consumption Standby Dynamic	Inputs grounded, no output load, $V_{CC} = 5\text{ V}$, Temp. = 25 °C	I_{SB} I_{DD}		2	1	µA mA

**) Operation at $V_{CC} = 3\text{ V}$ is also specified. For data compare TEMIC Matra MHS ULC technology data sheet.

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Operation Description

Features only for TOIM3000

The TOIM3000 accepts 2 clocks from the UART: the 1.8432 MHz clock and the Baud_out clock for its internal time processing. Both are connected to XIN and B_CLK, respectively. The B_CLK is used as a reference for pulse stretching whereas XIN is used as a time base for pulse shortening to 1.617 µs and noise filtering.

Single clock operation

TOIM3000 can be operated with only a single clock. In this case, the B_CLK and XIN are tight together and connected to the Baudout pin of the UART. The pulse width is then shortened to 3/16 of the bit length and noise filtering is deactivated. S1 is to be connected to V_{CC} and SO to GND.

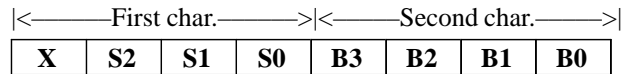
We strongly recommend not to use this mode in battery-operated systems because the 3/16 pulse length at lower bit rates consumes more power than the shorter pulses. At a baud rate of 9600 bit/s, the ratio of power consumption of both modes is a factor of 12 (!).

The TOIM3000 interfaces to an RS232 level converter through two pins, RD_232 and TD_232. These two pins provide the extra function that a single TOIM3000 IC can time share with both an infrared IrDA port and an RS232 port. Whenever RESET = 0, then the TOIM3000 links to the infrared transceiver TFDS3000 through RD_IR and TD_IR pins. On the other hand, when RESET = 1, the TOIM3000 links to the RS232 port through RD_232 and TD_232 pins (see figure 1).

Features only for TOIM3232

The baud rate at which an RS232 serial port communicates with the external adapter is programmable inside the TOIM3232. This programmable baud rate is especially useful when the baud clock and the UART oscillator clock are not available. When BR/D = 0, the TOIM3232 interprets the signals at RD_232 and RD_IR pins as data to be transmitted and received data. On the other hand, whenever BR/D = 1, the TOIM3232 interprets the seven LSBs at the RD_232 input as the control word. The operating baud rate will change to its supposedly new baud rate when the BR/D returns back to LOW ("0") (see figure 2).

Control Byte (8 bit)



where

- X: Don't care
- S1, S2: User-programmable bit
- S0: IrDA pulse select
 - = (1) 1.617 µs output pulses
 - = (0) 3/16 bit time pulses *)
- B0 .. B3: Baud rate selects, B0 = LSB

*) not recommended

Baud Rate Select Words

Note: IrDA standard only supports 2.4, 9.6, 19.2, 38.4, 57.4 and 115.2 kbit/s.

B3	B2	B1	B0	Second Char.	Baud Rate
0	0	0	0	0	115.2 k
0	0	0	1	1	57.4 k
0	0	1	0	2	38.4 k
0	0	1	1	3	19.2 k
0	1	0	0	4	14.4 k
0	1	0	1	5	12.8k
0	1	1	0	6	9.6k
0	1	1	1	7	7.2 k
1	0	0	0	8	4.8 k
1	0	0	1	9	3.6 k
1	0	1	0	A	2.4 k
1	0	1	1	B	1.8 k
1	1	0	0	C	1.2 k
1	1	0	1	D	600
1	1	1	0	E	Not used
1	1	1	1	F	Not used

Software for the TOIM3232

The control word is composed of two characters, written in hexadecimal, in format:YZ.

UART Programming

For proper operation, the RS232 must be programmed to send a START bit plus an 8 bit data word, YZ and no STOP bit for every word sent. The transfer rate for programming must be identical with the formerly programmed data rate, or after resetting the TOIM3232, the default rate of 9600 bit/s is used.

Software Algorithm

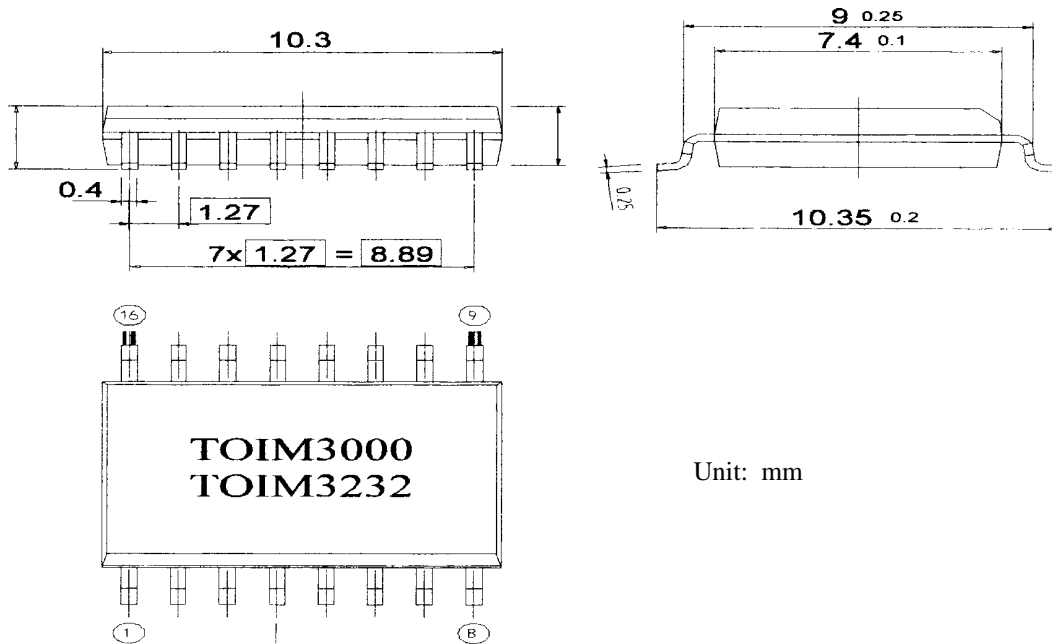
STEP	RESET	BR/D	Rx_UART	Tx_UART	Rx_IR	Tx_IR	COMMENTS
1	HIGH	X	X	X	X	X	Resets all internal registers. Resets IrDA default baud rate of 9600 bit/s.
2	LOW	X	X	X	X	X	Wait at least 7 μ s.
3	LOW	HIGH	X	X	X	X	Wait at least 7 μ s. The TOIM3232 now enters the control word (programming) mode.
4	LOW	HIGH	YZ with Y = 1 for 1.617 μ s Y = 0 for 3/16 bit length	X	X	X	Sending the control word YZ. Send '1Z' if 1.617 μ s pulses are used. Otherwise send '0Z' if 3/16 bit pulses are used. 'Y6' keeps the 9.6 kbit/s data rate whereas the '0Z' selects the 3/16 bit time pulses. Z = 0 sets to 115.2 kbit/s. Then wait at least 1 μ s for hold-time.
5	LOW	LOW	DATA	DATA	DATA	DATA	Data communication between the TOIM3232 and the RS232 port has been established by BR/D LOW. The TOIM3232 now enters the data transmission mode. Both RESET and BR/D must be kept LOW ('0') during data mode. Software can re-program a new data rate by re-starting from step 3. The UART also must be set to the correct data rate ***).

***)) For programming the UART, refer to, e.g., National Semiconductor's data sheet of PC 16550 UART.

TOIM3000/3232

SO16 Package and Pin Assignment of TOIM3000

(PLD package and pin assignment of TOIM3000 on request,
SO16 package of TOIM3232: pin configuration: tbd, PLD on request)



Unit: mm