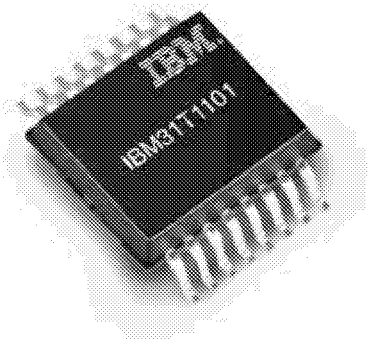
IBM31T1101

INFRARED TRANSCEIVER SOIC

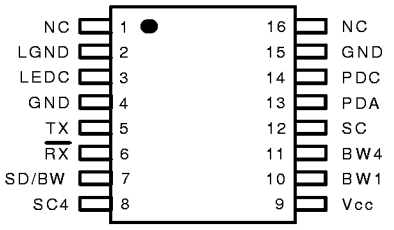
DATASHEET



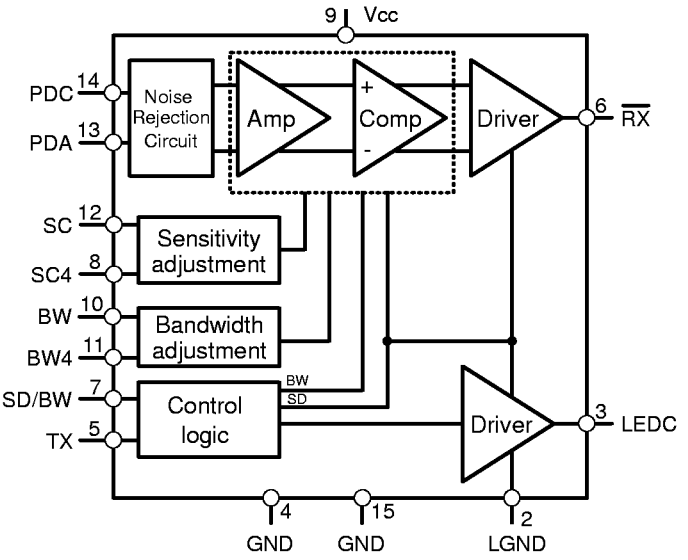
REVISION 1.2

Highlights

- IrDA, HP-SIR and Sharp ASK compatible
- Supports IrDA data rates up to 4Mbps
- Low profile 16 pin SSOP
- Minimum external components
- Low power consumption
- 5V Supply Voltage
- Complete differential receiver design
- Ambient light and noise rejection circuitry
- Shutdown pin for power management
- Programmable bandwidth control



16 pin SSOP



Block Diagram

General Description

The IBM31T1101 is a multi-mode infrared transceiver SOIC (Small Outline Integrated Circuit) for data communication systems. The transceiver supports all IrDA speeds up to 4Mbps, HP-SIR and Sharp ASK modes. A photodiode, LED, LED current limiting resistor and a Vcc bypass capacitor are the only mandatory components required to implement a complete transceiver. The low power consumption of the receiver makes the IBM31T1101 ideal for use in battery operated or mobile products. A shutdown mode provides for additional power management.

Pin Descriptions

LGND *Ground* (Power). This ground pin provides a separate ground path for the LED driver circuit.

LEDC *LED Cathode* (Output). Connect to the LED Cathode. A Low indicates the LED is active.

GND *Ground* (Power). Connect to ground of the power supply. A solid ground plane is recommended for proper operation.

TX *Transmit Data* (Input, active High). This input transmits serial data when SD/BW is Low. This pin also programs the bandwidth of the IBM31T1101. When SD/BW pulses, the trailing edge of SD/BW latches the state of TX to determine the bandwidth setting. The IBM31T1101 operates up to 1.2 Mbps when TX is Low. The IBM31T1101 operates at 4 Mbps when TX is High.

$\overline{\text{RX}}$ *Receive Data* (Output, active Low). This output indicates received serial data. It is a push-pull CMOS driver capable of driving a standard CMOS or TTL load. An external pull-up or pull-down resistor is not required. This output may switch indeterminately when the IBM31T1101 is transmitting.

SD/BW *Shutdown/Bandwidth* (Input, active High). This CMOS input programs the IBM31T1101 into Shutdown mode. Nominal current draw in this mode is 35 uA versus 5 mA in normal mode. Together with the TX input, this pin also sets the receiver bandwidth. If TX is low when SD/BW transitions from high to low, the receiver bandwidth is optimized for operation up to 1.2 Mbps. If TX is high when SD/BW transitions from high to low, the receiver bandwidth is optimized for operation at 4 Mbps. The IBM31T1101 powers on with the upper limit of the bandwidth set to 1.2 Mbps operation. Note that the internal LED driver is disabled when SD is active and is not enabled until the next rising edge of TX. This assures that the LED(s) will not be active during bandwidth adjustment. This pin has an internal 200K ohm resistor to GND. It is recommended that this pin be connected to GND if bandwidth adjustment or shutdown mode is not used.

SC4 *Sensitivity Control - 4 Mbps* (Input). This *optional* input may be used to control the receiver sensitivity when bandwidth is set for 4 Mbps operation. In most implementations, this pin should be left as a no-connect. A pull-up resistor connected to Vcc will decrease the sensitivity. Connecting the resistor to GND will increase the sensitivity.

Vcc *5V* (Power). Connect to +5V power supply. It is recommended that a 1uF bypass capacitor be placed as close as possible to this pin.

BW1 *Bandwidth Control* - (Input). This *optional* input may be used to control the receiver bandwidth for all data rates. In most implementations, this pin should be left as a no-connect. A pull-up resistor connected to Vcc will decrease the bandwidth. Connecting the resistor to GND will increase the bandwidth.

BW4 *Bandwidth Control - 4 Mbps* (Input). This *optional* input may be used to control the receiver bandwidth when set for 4 Mbps operation. In most implementations, this pin should be left as a no-connect. A pull-up resistor connected to Vcc will decrease the bandwidth. Connecting the resistor to GND will increase the bandwidth.

SC *Sensitivity Control* (Input). This *optional* input may be used to control the receiver sensitivity for all data rates. In most implementations, this pin should be left as a no-connect. A pull-up resistor connected to Vcc will decrease the sensitivity. Connecting the resistor to GND will increase the sensitivity.

PDA *Photodiode Anode* (Input). This input connects to the photodiode Anode. Place the photodiode as close as possible to the IBM31T1101.

PDC *Photodiode Cathode* (Output). This output connects to the photodiode Cathode. Place the photodiode as close as possible to the IBM31T1101.

Electrical and Timing Specifications –

Absolute Maximum Ratings

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Unit*	*Condition*
V_{CC}	Supply Voltage Range	- 0.5		6	V	
P_D	Power Dissipation			200	mW	
T_J	Junction Temperature			100	°C	
	Storage Temperature Range	- 25		85	°C	
I_{LED}	LED Current			0.8	A	<2µs, t_{on}<10%
	Voltage at Any Pin	- 0.5		V_{cc}+0.5	V	

Recommended Operating Conditions

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Unit*	*Condition*
V_{CC}	Supply Voltage	4.5	5	5.5	V	
T_A	Operating Temperature Range	0		70	°C	

DC Electrical Characteristics

T_A = 0-70°C, V_{CC} = 5V ±10%, unless otherwise specified

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Unit*	*Condition*
I_{CC}	Dynamic Supply Current		5	7	mA	SD=0V, TX=Low
I_{CC}	Standby Supply Current		35	70	µA	SD=5V, Pins 8,10-12 are NC.
I_{LED}	Repetitive Pulsed LED Current			0.6	A	<90µs, t_{on}<25%
V_{OL}	$\overline{RX}$ Output Voltage Low @ I_{OL} = 2.5mA		0.3	0.5	V	
V_{OH}	$\overline{RX}$ Output Voltage High @ -I_{OH} = 2.5Ma	V_{CC}-0.5			V	
V_{IL}	Input Voltage Low (TX, SD/BW)	0		0.8	V	
V_{IH}	Input Voltage High (TX)	2.0			V	
V_{IH}	Input Voltage High (SD/BW)	V_{CC}-0.5			V	
I_L	Input Leakage Current	-10		+10	µA	
C_I	Input Capacitance			5	pF	

AC Electrical Characteristics

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Unit*	*Condition*
t_R	$\overline{RX}$ Rise Time	10		35	ns	R_L=2.0KΩ, C=50pF
t_F	$\overline{RX}$ Fall Time	10		40	ns	R_L=2.0KΩ, C=50pF
t_S	TX Setup Time to SD/BW Low	200			ns	
t_H	TX Hold Time from SD/BW Low	200			ns	
t_{PW}	$\overline{RX}$ Pulse Width	0.8		20	µs	9.6 Kbps
t_{PW}	$\overline{RX}$ Pulse Width	100		500	ns	1.2 Mbps
t_{PW}	$\overline{RX}$ Pulse Width	60		165	ns	4 Mbps
t_{PW}	$\overline{RX}$ Pulse Width	185		290	ns	4 Mbps double pulse
t_D	Output Delay @ E_e = 40 mW/cm^2		1	2	µs	≤1.2 Mbps
t_L	Latency			120	µs	

Receiver Characteristics

Symbol	*Parameter*	*Min*	*Typ*	*Max*	*Unit*	*Condition*
I_{PD}	Photodiode Current	0.16		2×10^4	µA	≤115.2 Kbps
I_{PD}	Photodiode Current	0.4		2×10^4	µA	1.2, 4 Mbps
V_{PDC}	Photodiode Cathode Voltage	3.7			V	
V_{PDA}	Photodiode Anode Voltage			0.3	V	
C_{PD}	PDA, PDC Input Capacitance			20	pF	

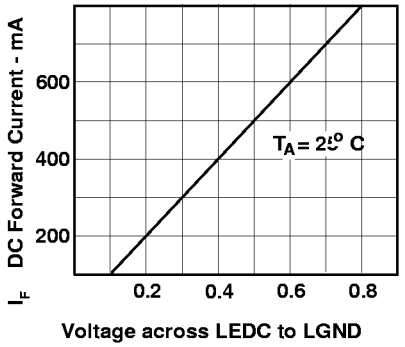


Figure 1. Peak LED Driver Current vs. Voltage across LEDC to LGND

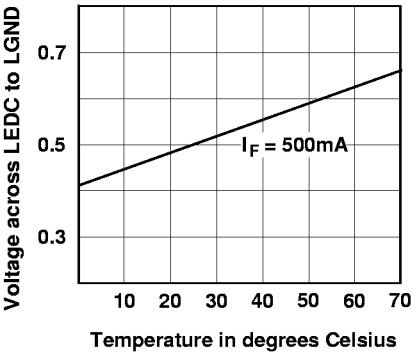


Figure 2. Voltage across LEDC to LGND vs. Temperature

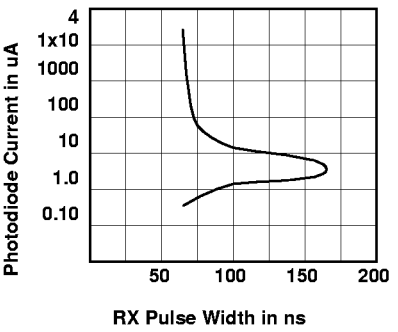


Figure 3. RX Pulse Width vs. Irradiance - 4Mbps mode

Timing Diagrams

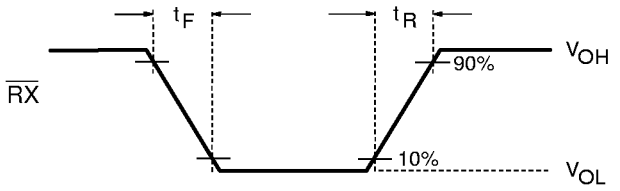


Fig. 4 RX Rise and Fall timing measurements

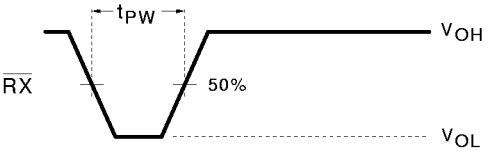


Fig. 5 RX Timing, MIR, FIR mode

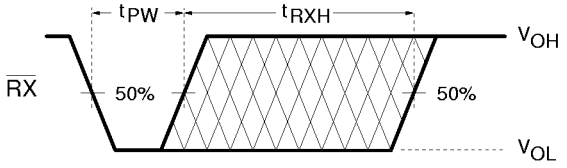


Fig. 6 RX Timing, SIR mode. The output is indeterminate in the shaded area. Spurious transitions may occur.

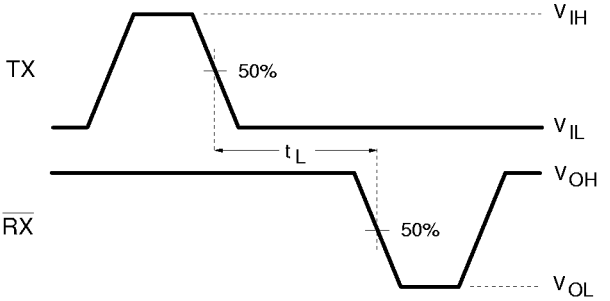


Fig. 7 Latency timing

Programming the Receiver Bandwidth

The IBM31T6100 powers on with the upper limit of the receiver bandwidth set to 1.2 Mbps operation. To set the bandwidth for operation at 4 Mbps, apply timings as shown in Figure 8 to the SD/BW and the TX inputs. Note that the internal LED driver is disabled when SD/BW is active and is not enabled until the next rising edge of TX. This ensures that the LED(s) will not be active during bandwidth adjustment. It is recommended that the SD/BW pin be connected to GND if bandwidth adjustment and shutdown mode are not used.

To switch the IBM31T6100 from the default state to 4 Mbps and vice versa, the programming specifications are as follows:

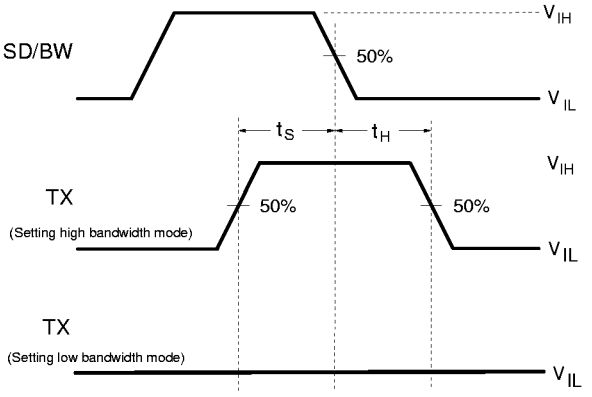


Figure 8. Bandwidth Programming

Setting the receiver to 4 Mbps mode

1. Set the SD/BW input to logic high.
2. Set the TX input to logic high. Wait $t_S \geq 200$ ns.
3. Set the SD/BW to logic low. (This high-to-low transition latches the state of TX, which determines the receiver bandwidth.)
4. After waiting $t_H \geq 200$ ns, set the TX input to logic low. The receiver is now in high bandwidth mode, the optimal setting for 4 Mbps operation.

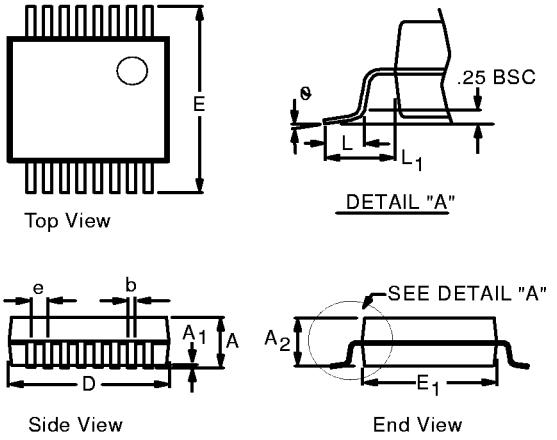
Setting the receiver to 9.6 kbps-to-1.2 Mbps mode

1. Set the SD/BW input to logic high.
2. Ensure that the TX input is at logic low. Wait $t_S \geq 200$ ns.
3. Set the SD/BW to logic low. (This high-to-low transition latches the state of TX, which determines the receiver bandwidth.)
4. Ensure that the TX input remains low for $t_H \geq 200$ ns. The receiver is now in low bandwidth mode, which is the optimal setting for data rates from 9.6 kbps to 1.2 Mbps.

Package Dimensions

Dimensions in mm

Dim	*Min*	*Nom*	*Max*
A	1.73	1.86	1.99
A1	0.05	0.13	0.21
A2	1.68	1.73	1.78
b	0.25		0.38
D	6.07	6.20	6.33
E	7.65	7.8	7.90
E1	5.00	5.30	5.38
e		0.65 BSC	
L	0.63	0.75	0.95
L1		1.25 REF	
θ	0°	4°	8°



Revision History

The following specifications have changed from the G325-4028-00 revision data sheet.

1. The VIH Input Voltage High spec was changed to 2.0V from 2.4V.
2. The min RX pulse width in 4Mbps mode changed to 50ns from 85ns.
3. A 4 Mbps mode double pulse width specification was added.
4. The min photodiode detection current for 1.2 Mbps was changed to 400nA from 160nA.
5. The RX output drive current specification was changed to 2.5mA from 4mA.

The following changes have been made in the specifications from the G325-5274-00 revision data sheet.

1. The VIH specification for the SD/BW input changed to Vcc-0.5V from 2.0V.
2. The timing diagrams are enhanced to show switching levels.
3. The RX fall time specification is 40ns instead of 35ns.
4. The min RX pulse width in 4Mbps mode was changed to 60ns from 50ns.
5. If a Temic BPV22NF diode is used, the recommended value for R_{BW} is 130KΩ to GND, and R_{BW4} is 36KΩ to GND.
6. If a Temic TSHF5400 LED is used, the R_{LED} recommended value changed to 3.9Ω from 3Ω.

IBM Microelectronics Division
1580 Route 52, Bldg. 504
Hopewell Junction, NY
12533-6531

The IBM home page can be found at http://www.ibm.com

The IBM Microelectronics Division home page can be found at
http://www.chips.ibm.com

Document No. GH45-5274-02