5 V Integrated Infrared Transceiver Family

Features

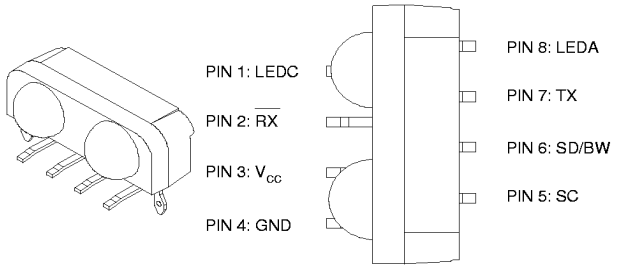
- 5 V Supply voltage
- Supports IrDA data rates up to 4 Mbit/s
- Excellent receive sensitivity
- Minimum required external components
- On-chip LED protection circuitry
- Low power consumption
- Complete differential receiver design
- Ambient light and noise rejection circuitry
- Shutdown pin for power savings
- Programmable bandwidth control
- Low profile (height = 5.9 mm max.)
- IEC825 Class 1 eye safe
- Supports HP-SIR and Sharp ASK
- Compatible with all major infrared controllers and super I/Os

Description

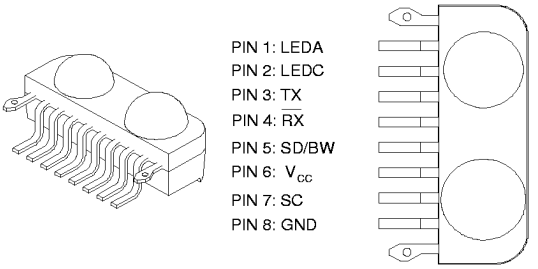
The 5 V family of transceivers is comprised of four multi-mode integrated infrared (IR) transceiver modules for wireless data communication systems. The transceivers support IrDA data rates up to 4 Mbit/s, as well as HP-SIR and Sharp ASK modulation schemes. Integrated into these small modules are a photodiode, LED and IBM's mixed-signal transceiver ASIC, providing a total solution in a single package. A current-limiting resistor in series with the LED and a V_{CC} bypass capacitor are the only external components required to implement a complete transceiver circuit. Four package styles are available, allowing alternate PCB mounting orientations.

Pin Assignments

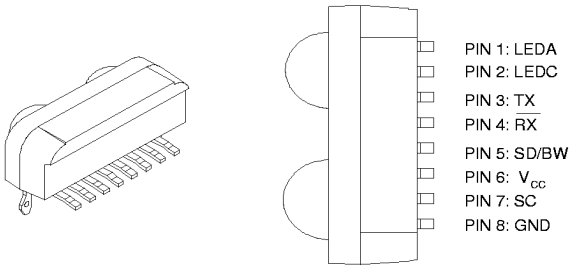
IBM31T1100B (Standard Package)



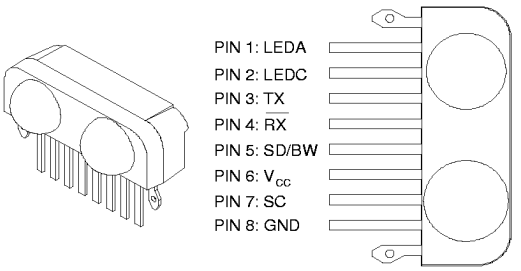
IBM31T11TV (Top View)



IBM31T11SV (Side View)



IBM31T11SL (Straight Lead)



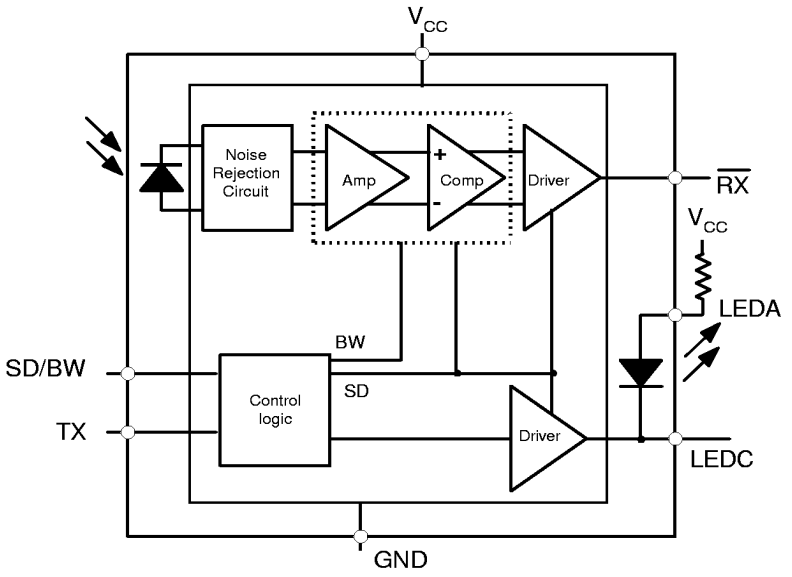
Input/Output Functional Description

Symbol	Type	Polarity	Function
TX	Input	High	Used to transmit serial data when SD/BW is low. This CMOS input controls the LED driver. An on-chip protection circuit disables the LED driver if TX is high for more than 60 µs. This pin is also used to program the bandwidth of the receiver. See SD/BW pin description.
$\overline{RX}$	Output	Low	Indicates received serial data. It is a push-pull CMOS driver capable of driving a standard CMOS or TTL load. No external pull-up or pull-down resistor is required. May switch indeterminately when the module is transmitting.
SD/BW	Input	High	This CMOS input is used to put the unit in shutdown mode. Nominal supply current draw in this mode is 35 µA 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 shifts from high to low, the receiver bandwidth is optimized for operation up to 1.2 Mbit/s. If TX is high when SD/BW shifts from high to low, the receiver bandwidth is optimized for operation at 4 Mbit/s (see Figure 12 on page 8).
LEDA	Input		Connect this input to V_{CC} through a resistor to set the proper LED current. Add an external LED in series to increase output intensity if required.
LEDC	Output	Low	Indicates the state of the internal LED cathode. Normally not connected.
V_{CC}			Connect to +5 V power supply. Place a 1.0 µF to 10 µF ceramic bypass capacitor as close as possible to this pin.
GND			Connect to ground of the power supply. A solid ground plane is recommended for proper operation.
SC			Reserved pin for sensitivity control. Typically, no signal should be connected to this pin.
Guide Pins			The through-hole guide pins offer mechanical stability during board mounting.

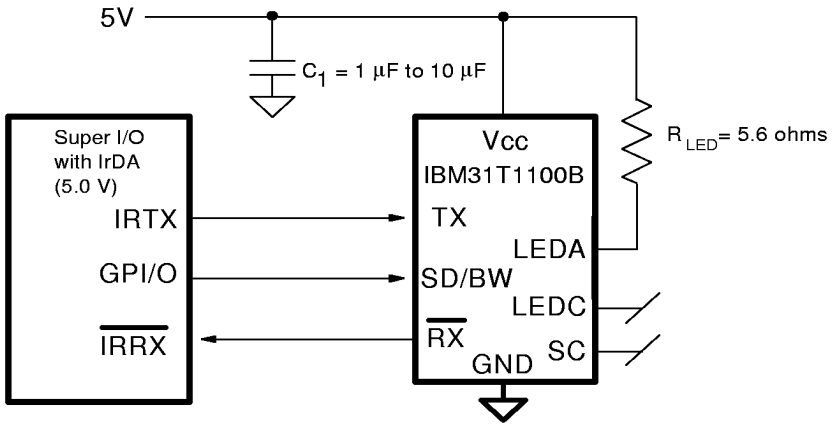
Ordering Information

Part Number	Description	PCB Mounting and Orientation
IBM31T1100B	Standard Package	Surface mount, facing the side (IBM31T1100A replacement)
IBM31T1100TV	Top View Package	Surface mount, facing the top
IBM31T1100SV	Side View Package	Surface mount, edge of PCB, facing the side
IBM31T1100SL	Straight Lead Package	Pin-through-hole mount, facing the side

Block Diagram



Typical IBM 5 V Infrared Transceiver Circuit Diagram



Note: Same circuit is used for 31T11TV, 31T11SV, and 31T11SL.

Absolute Maximum Ratings

Symbol	Parameter	Min	Typical	Max	Unit	Conditions
V_{CC}	Supply Voltage Range	-0.5		6	V	
PD	Power Dissipation			450	mW	
T_J	Junction Temp.			125	°C	
T_{STG}	Storage Temp.	-25		85	°C	
	Soldering Temp.			240	°C	
I_{LED}	LED Current			800	mA	t_{on} <2 µs and t_{on}<10%
	Voltage at any pin	-0.5		V_{CC}+0.5	V	

Recommended Operating Conditions

Symbol	Parameter	Min	Typical	Max	Unit	Conditions
V_{CC}	Supply Voltage	4.5	5	5.5	V	
T_A	Ambient Operating Temperature	0		70	°C	
R_L	Load resistance			2	KΩ	
C_L	Load capacitance			50	pF	

DC Electrical Characteristics T_A = 0 °C to 70 °C, V_{CC}=5 V ± 10%, unless otherwise specified

Symbol	Parameter	Min	Typical	Max	Unit	Conditions
I_{CC}	Dynamic Supply Current		5	7	mA	SD= 0 V
I_{SD}	Shutdown Supply Current		35	100	µA	SD= V_{CC}-0.5 V
I_{LED}	Repetitive Pulsed LED Current			550	mA	t_{on}<60 µs and t_{on} ≤ 25%
V_{OL}	$\overline{RX}$ Output Voltage Low		0.3	0.5	V	I_{OL} = 2.5 mA
V_{OH}	$\overline{RX}$ Output Voltage High	V_{CC} - 0.5			V	I_{OH} = 2.5 mA
V_{IL}	Input Voltage Low (TX,SD/BW)			0.8	V	
V_{IH}	Input Voltage High (TX)	3.0			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 T_A = 0 °C to 70 °C, V_{CC}=5 V ± 10%, unless otherwise specified

Symbol	Parameter	Min	Typical	Max	Unit	Conditions
t_{PLH}	$\overline{RX}$ Rise Time	10		40	ns	R_L=2 kΩ, C_L=50 pF
t_{PHL}	$\overline{RX}$ Fall Time	10		40	ns	R_L=2 kΩ, C_L=50 pF
t_{su}	TX Setup Time to SD/BW Low	200			ns	
t_h	TX Hold Time from SD/BW Low	200			ns	
t_w	$\overline{RX}$ Pulse Width 9.6 kbit/s	0.8		20	µs	R_L=2 kΩ, C_L=50 pF
t_w	$\overline{RX}$ Pulse Width 1.2 Mbit/s	100		800	ns	R_L=2 kΩ, C_L=50 pF
t_w	$\overline{RX}$ Pulse Width 4 Mbit/s	80 [1]		165 [2]	ns	Single pulse, 9 µW/cm² < E_e <500 mW/cm² R_L=2 kΩ, C_L=50 pF
t_w	$\overline{RX}$ Pulse Width 4 Mbit/s	210		290	ns	Double pulse, 9 µW/cm² < E_e <500 mW/cm² R_L=2 kΩ, C_L=50 pF
t_d	Output Delay @E_e=40mW/cm²		1	2	µs	≤ 1.2 Mbit/s
t_L	Latency			120	µs	
t_{RXEN}	$\overline{RX}$ Valid After Shutdown			60	µs	
t_{DIS_LED}	LEDC Inactive After TX High			60	µs	

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

Symbol	Parameter	Min	Typical	Max	Unit	Conditions
E_{emin}	Minimum Detection Irradiance		2.5	3.5	µW/cm²	9.6 kbit/s to 115.2 kbit/s
E_{emin}	Minimum Detection Irradiance		3.5	5.0	µW/cm²	1.2 Mbit/s
E_{emin}	Minimum Detection Irradiance		7.0 [3]	8.0	µW/cm²	4 Mbit/s
E_{emax}	Maximum Detection Irradiance	500			mW/cm²	All speeds
I_e	Output Radiant Intensity	100	140	320 [3]	mW/sr	TX=High,SD=Low, R_{LED}=5.6 Ω, V_{CC}=5 V, α=0°,α = ±15°, T_A=25°C
				0.4	µW/sr	TX=Low or SD=High, R_{LED}=5.6 Ω, V_{CC}=5 V, α=0°, α = ±15°, T_A=25°C
α	Output Radiant Intensity Half Angle		±24		°	
λ_P	Peak Wavelength	880		900	nm	
	Optical Overshoot			25	%	

1. For E_e <9 µW/cm² , 4 Mbit/s Min $\overline{RX}$ Pulse Width is 60 ns
2. For V_{CC} < 4.75 V , 4 Mbit/s Max $\overline{RX}$ pulse width is 175 ns
3. Maximum intensity specified for class 1 operation of IEC 825-1

Transceiver Characteristics

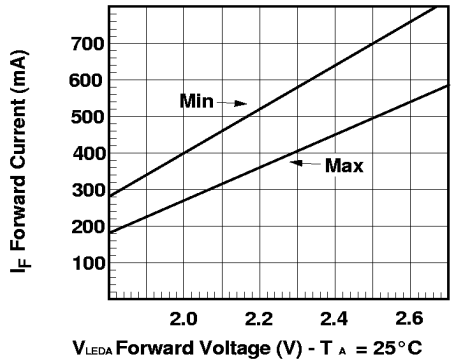


Figure 1. V_{LEDA} vs. peak LED current

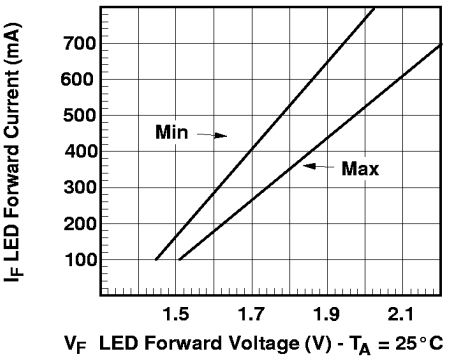


Figure 2. LED Forward Voltage vs. Current

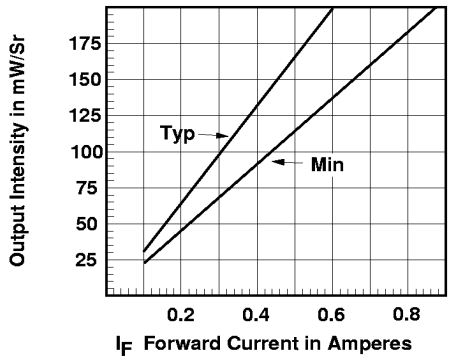


Figure 3. Output Intensity vs. Current

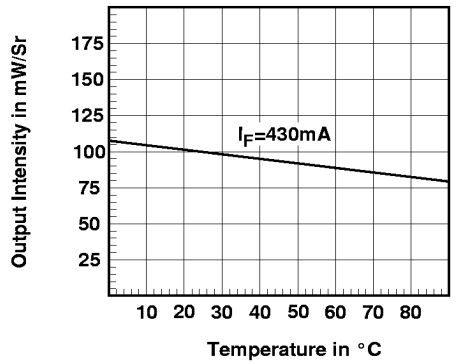


Figure 4. Output Intensity vs. Temperature

Reflow Soldering

Extreme care is required to ensure that during reflow the case temperature of the IBM 5 V Infrared Transceiver does not exceed 230°C for more than 10 seconds and the peak case temperature does not exceed 240°C. Due to the variety of card assemblies, and depending on the reflow method (IR versus vapor phase), case temperatures should be verified prior to volume manufacture. Figure 5 illustrates a recommended profile.

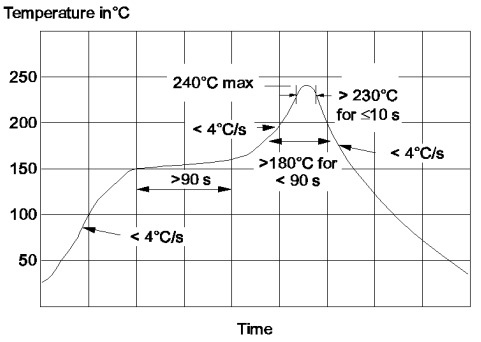


Figure 5. Recommended Reflow Profile

GH45-5249-01
Revised 12/02/98

Timing Diagrams

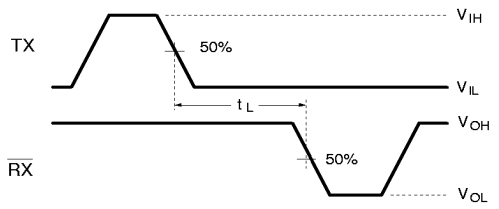


Figure 6. Latency Timing

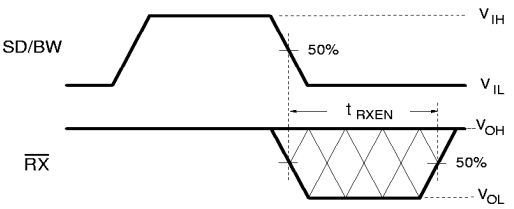


Figure 7. $\overline{RX}$ Valid after Shutdown

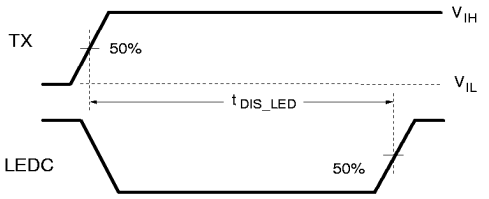


Figure 8. LED Protection Timing

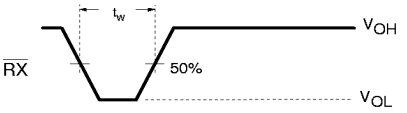


Figure 9. $\overline{RX}$ Timing 1.2 and 4 Mbit/s Mode

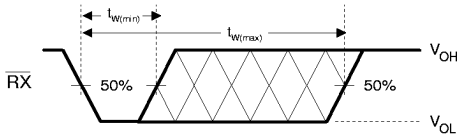


Figure 10. $\overline{RX}$ Timing, SIR mode. The output is indeterminate in the shaded area. Spurious transitions may occur.

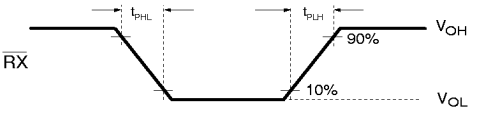


Figure 11. $\overline{RX}$ Rise and Fall Timing Measurements

Bandwidth Programming

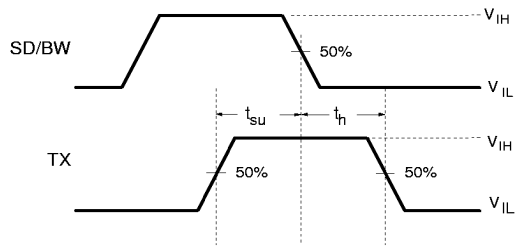


Figure 12. Setting the Receiver to 4 Mbit/s Mode

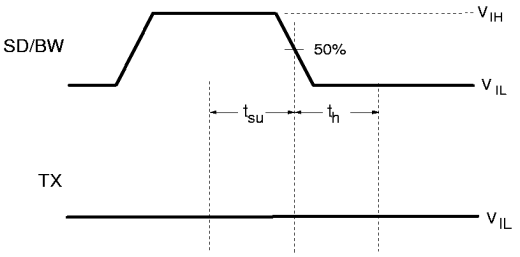


Figure 13. Setting the Receiver to 9.6 kbit/s-to-1.2 Mbit/s Mode

The transceiver powers on with the upper limit of the receiver bandwidth set to 1.2 Mbit/s operation. To set the bandwidth for operation at 4 Mbit/s, apply timings as shown in the figure, 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 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 transceiver from the default state to 4 Mbit/s and vice versa, the following programming specifications should be used:

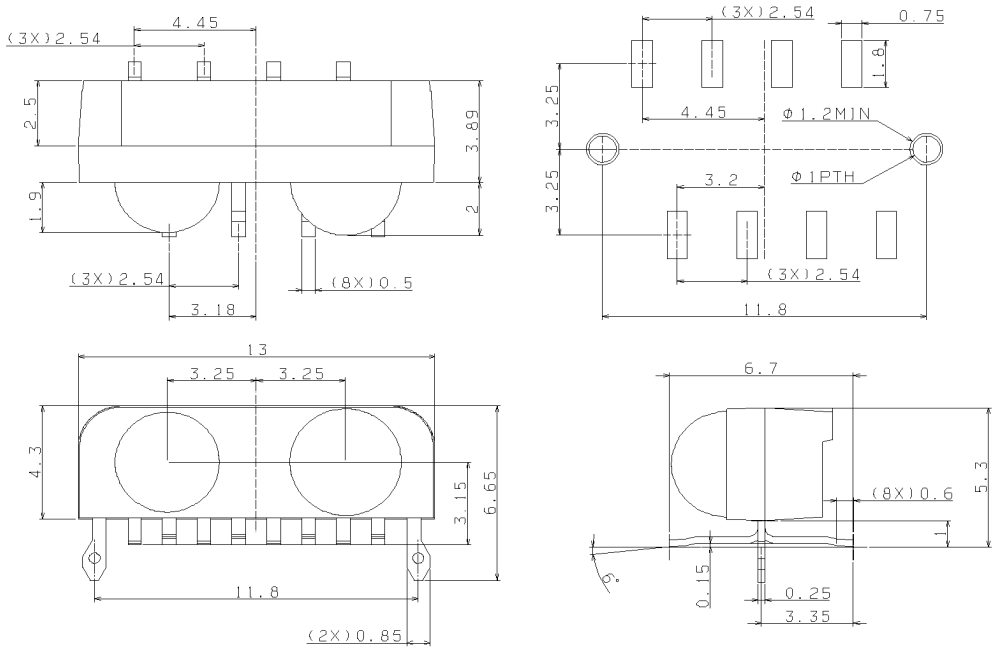
Setting the Receiver to 4 Mbit/s Mode (see Figure 12)

1. Set the SD/BW input to 'logic high'.
2. Set the TX input to 'logic high'. Wait $t_{SU} \geq 200$ 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 Mbit/s operation.

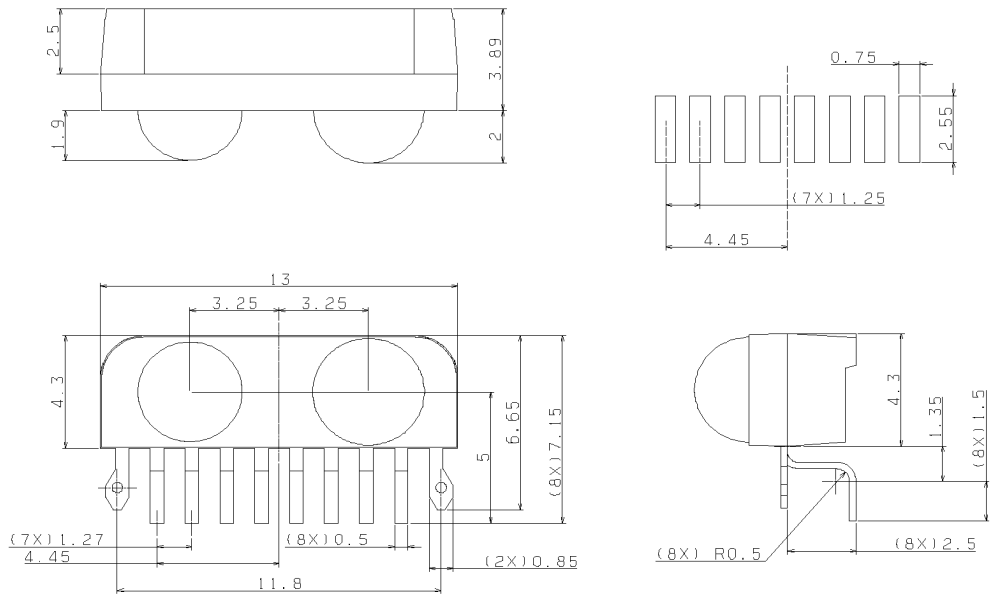
Setting the Receiver to 9.6 kbit/s-to-1.2 Mbit/s Mode (see Figure 13)

1. Set the SD/BW input to 'logic high'.
2. Ensure that the TX input is at 'logic low'. Wait $t_{SU} \geq 200$ 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 kbit/s to 1.2 Mbit/s.

Package Diagram and PCB Pad Placement - Standard Package

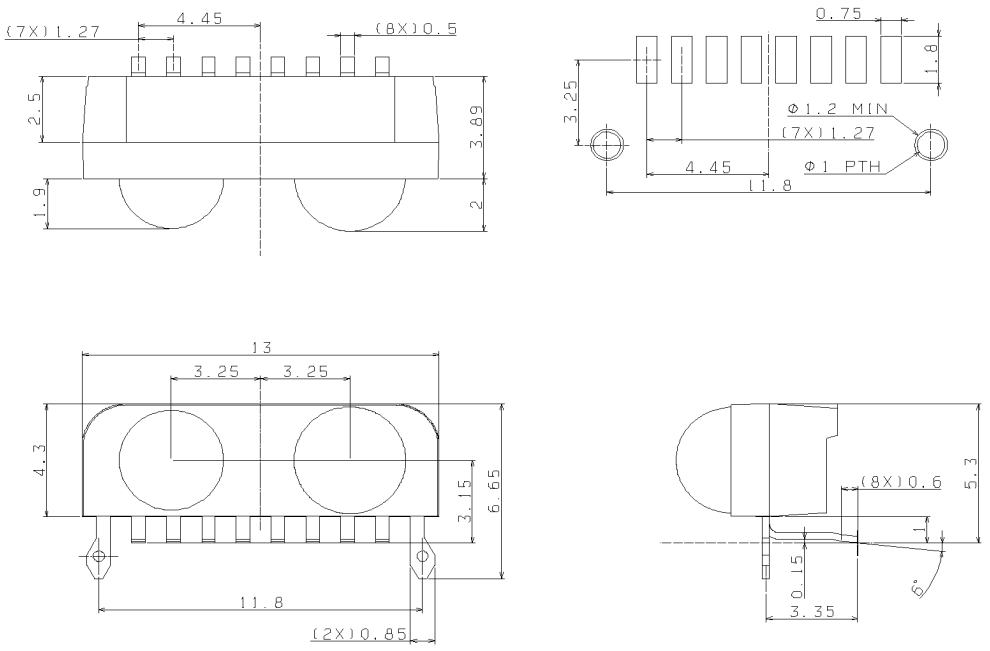


Package Diagram and PCB Pad Placement - Top View Package

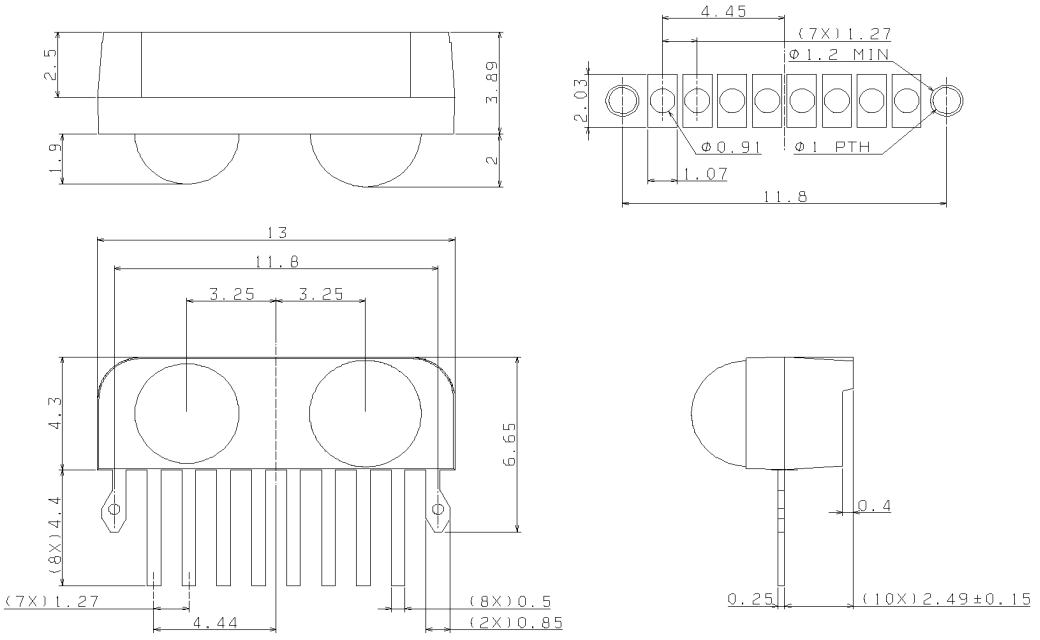


Note: Same circuit is used for 31T11TV, 31T11SV, and 31T11SL.

Package Diagram and PCB Pad Placement - Side View Package

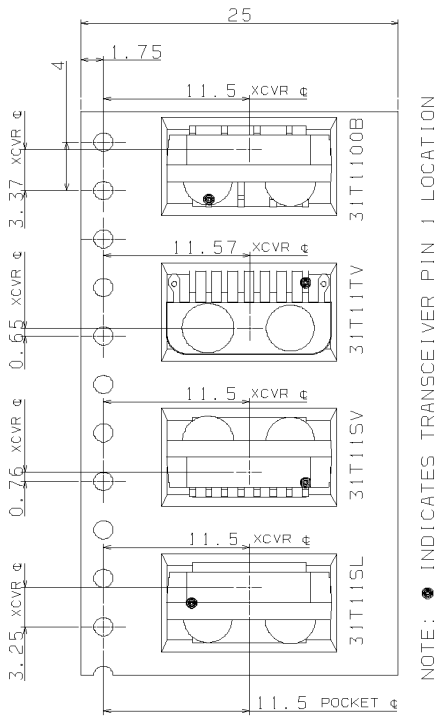


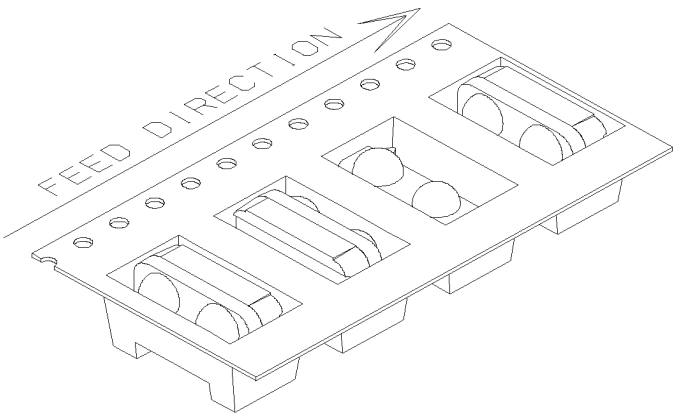
Package Diagram and PCB Pad Placement - Straight Lead Package



Note: For all package styles, to maximize heat conduction from the LED, the board designer should enlarge the LEDC pad.

Tape and Reel Diagram





Revision Log

Revision No.	Date	Contents Of Modification
00	08/20/98	Initial release.
01	12/02/98	Added “Tape and Reel” diagram. Added Typical Circuit. Updated: Pulse width, data