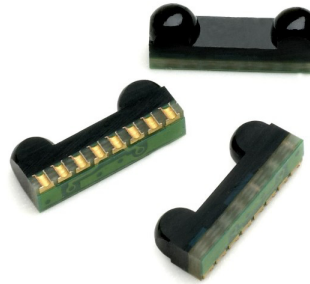


ASDL-3007

IrDA® Data Compliant Low Power 115.2 Kbit/s
with Remote Control Infrared Transceiver



Data Sheet



Description

The ASDL-3007 is a new generation ultra-low profile enhanced infrared (IR) transceiver module that provides the capability of (1) interface between logic and IR signals for through-air, serial, half-duplex IR data link, and (2) IR remote control transmission for universal remote control applications. The ASDL-3007 can be used for IrDA as well as remote control application without the need of any additional external components for multiplexing.

The ASDL-3007 is fully compliant to IrDA® Physical Layer specification version 1.4 low power from 9.6 kbit/s to 115.2 kbit/s (SIR) and IEC825 Class 1 eye safety standards.

ASDL-3007 can be shutdown completely to achieve very low power consumption. In the shutdown mode, the PIN diode will be inactive and thus producing very little photocurrent even under very bright ambient light. It is also designed especially for battery operated mobile devices such as PDAs and mobile phones that require low power consumption.

Applications

- Mobile data communication and universal remote control
 - Mobile Phones
 - PDAs
 - Printers
 - Industrial and Medical Instrument

Features

General Features

- Operating temperature from -25°C to +85°C
 - Critical parameters are guaranteed over temperature and supply voltage
- Vcc Supply 2.4 to 3.6V
- Miniature Package
 - Height : 1.60 mm
 - Width : 7.00 mm
 - Depth : 2.80 mm
- Moisture Level 3
- Integrated remote control LED driver
- LED Stuck-High Protection
- High EMI performance without shield
- Designed to Accommodate Light Loss with Cosmetic Windows
- IEC 825-Class 1 Eye Safe
- Lead Free and ROHS Compliant

IrDA® Features

- Fully Compliant to IrDA 1.4 Physical Layer Low Power Specifications from 9.6 kbit/s to 115.2 kbit/s
- Link distance up to 50cm typically
- Complete shutdown
- Low Power Consumption
 - Low shutdown current
 - Low idle current

Remote Control Features

- Wide angle and high radiant intensity
- Spectrally suited to remote control transmission function
- Typical link distance up to 8 meter

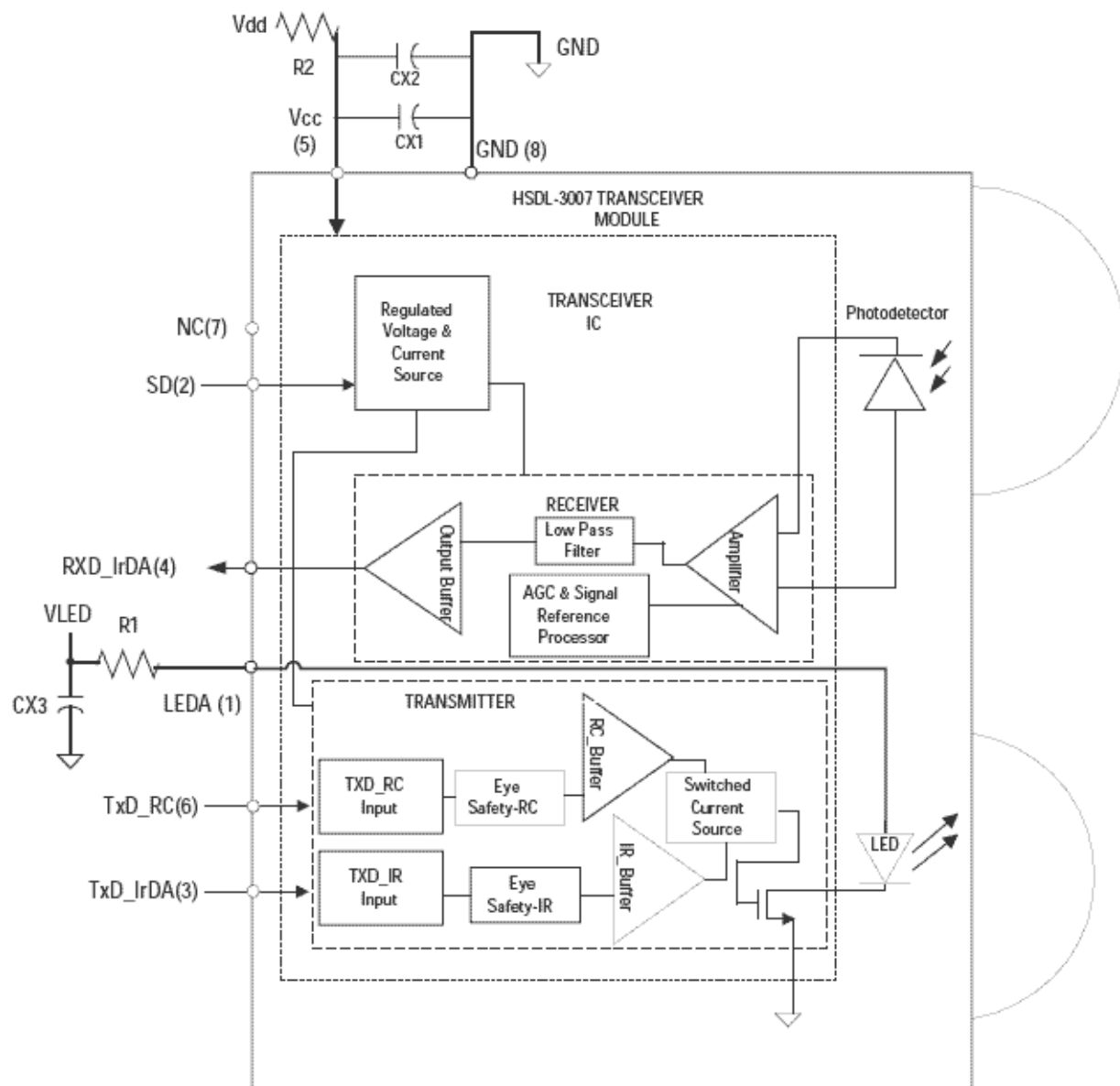


Figure 1. Functional Block Diagram of ASDL-3007

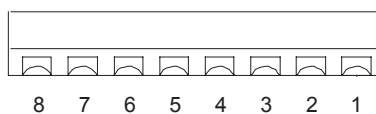


Figure 2. Pin out for ASDL-3007

Application Support Information

The Application Engineering Group is available to assist you with the application design associated with ASDL-3007 infrared transceiver module. You can contact them through your local sales representatives for additional details.

Order Information

Part Number	Packaging Type	Package	Quantity
ASDL-3007-021	Tape and Reel	Front Option	2500

Marking Information

The unit is marked with 'PYWWLL' on the back of the PCB for front option without shield.

P = Product Code

Y = Year

WW = Work Week

LL = Lot Number

I/O Pins Configuration Table

Pin	Symbol	Description	I/O Type	Notes
1	LEDA	LED Anode		Note 1
2	SD	Shutdown	Input. Active High	Note 2
3	TxD_IR	IrDA transmitter data input.	Input. Active High	Note 3
4	RxD	IrDA receive data	Output. Active Low	Note 4
5	Vcc	Supply Voltage		Note 5
6	TxD_RC	RC transmitter data input.	Input. Active High	Note 6
7	NC			Note 7
8	GND	Ground		Note 8

Notes:

1. Tied through external resistor, R1, to Vled. Refer to the table below for recommended series resistor value.
2. Complete shutdown of IC and PIN diode. The pin is used for setting receiver bandwidth and RC drive programming mode. Refer to section on "Bandwidth Selection Timing" and "Remote Control Drive Modes" for more information. Do NOT float this pin.
3. This pin is used to transmit serial data when SD pin is low. If held high for longer than 50 μ s, the LED is turned off. Do NOT float this pin.
4. This pin is capable of driving a standard CMOS or TTL load. No external pull-up or pull-down resistor is required. The pin is in tri-state when the transceiver is in shutdown mode.
5. Regulated, 2.4V to 3.6V
6. Logic high turns on the RC LED. If held high longer than 50 μ s, the RC LED is turned off. Do NOT float the pin.
7. NC.
8. Connect to system ground.

CAUTIONS: The CMOS inherent to the design of this component increases the component's susceptibility to damage from electrostatic discharge (ESD). It is advised that normal static precautions be taken in handling and assembly of this component to prevent damage and/or degradation which may be induced by ESD

Recommended Application Circuit Components

Component	Recommended Value	Note
R1	2.7 ohm $\pm 5\%$, 0.25W for $2.4V \leq V_{led} \leq 2.7V$ 3.9 ohm $\pm 5\%$, 0.25W for $2.7V \leq V_{led} \leq 3.0V$ 5.6 ohm $\pm 5\%$, 0.25W for $3.0V \leq V_{led} \leq 3.3V$ 9.1 ohm $\pm 5\%$, 0.25W for $3.3V \leq V_{led} \leq 4.2V$	
R2	4.7 ohm $\pm 5\%$	2
CX1	100 nF, $\pm 20\%$, X7R Ceramic	1
CX2,CX3	4.7 μ F, $\pm 20\%$, Tantalum	1

Notes :

1. CX1, CX2 must be placed within 0.7cm of ASDL-3007 to obtain optimum noise immunity
2. To reduce noise at VCC.

Absolute Maximum Ratings

For implementations where case to ambient thermal resistance is $\leq 50^{\circ}\text{C/W}$.

Parameter	Symbol	Min.	Max.	Units	Conditions	Notes
Storage Temperature	T_S	-40	+100	$^{\circ}\text{C}$		
Operating Temperature	T_A	-25	+85	$^{\circ}\text{C}$		
LED Anode Voltage	V_{LEDA}	0	6.5	V	$V_{ledA} < V_{cc} + 4V$	
Supply Voltage	V_{CC}	0	6.5	V		
Input Voltage : TXD	V_{TXD}	0	V_{cc}	V		
Input Voltage : SD/Mode	V_{SD}	0	V_{cc}	V		
Output Voltage : RXD	V_O	0	V_{cc}	V		
DC LED Transmit Current	$I_{LED} (DC)$		32	mA		
Peak Transmit Current (RC)	$I_{LED} (PK)_{RC}$		1	A	$\leq 8\%$ duty cycle, $\leq 90 \mu s$ pulse width	1
Peak Transmit Current (IrDA)	$I_{LED} (PK)_{IR}$		0.5	A	$\leq 20\%$ duty cycle, $\leq 90 \mu s$ pulse width	2

Notes:

1. This peak current is specified for RC mode
2. This peak current is specified for IrDA mode

Recommended Operating Conditions

Parameter		Symbol	Min.	Typ.	Max.	Units	Conditions
Operating Temperature		T_A	-25		+85	°C	
Supply Voltage		V_{CC}	2.4		3.6	V	
LED Anode Voltage		V_{LEDA}			5.5	V	$V_{LEDA} < V_{CC} + 4V$
Logic Input Voltage for TXD IR	Logic High	V_{IH-IR}	$V_{CC}-0.5$		V_{CC}	V	
	Logic Low	V_{IL-IR}	0		0.4	V	
Logic Input Voltage for TXD RC	Logic High	V_{IH-RC}	$V_{CC}-0.5$		V_{CC}	V	
	Logic Low	V_{IL-RC}	0		0.4	V	
Logic Input Voltage for SD	Logic High	V_{IH-SD}	$V_{CC}-0.5$		V_{CC}	V	
	Logic Low	V_{IL-SD}	0		0.4	V	
Receiver Input Irradiance	Logic High	E_{IH}	0.0090		500	mW/cm ²	For in-band signals ≤ 115.2 kbit/s ^[3]
	Logic Low	E_{IL}			0.3	μW/cm ²	For in-band signals ^[3]
LED (Logic High) Current Pulse Amplitude (IR)		I_{LEDA}		40		mA	
LED (Logic High) Current Pulse Amplitude (RC)		I_{LEDA}		150		mA	
Receiver Data Rate				9.6		115.2	kbit/s
Ambient Light							See IrDA Serial Infrared Physical Layer Link Specification, Appendix A for ambient levels

Note :

[1] An in-band optical signal is a pulse/sequence where the peak wavelength, λ_p , is defined as $850 \leq \lambda_p \leq 900$ nm, and the pulse characteristics are compliant with the IrDA Serial Infrared Physical Layer Link Specification v1.4.

Electrical and Optical Specifications

Specifications (Min. & Max. values) hold over the recommended operating conditions unless otherwise noted. Unspecified test conditions may be anywhere in their operating range. All typical values (Typ.) are at 25°C, Vcc set to 3.0V unless otherwise noted.

Parameter		Symbol	Min.	Typ.	Max.	Units	Conditions
Receiver							
Viewing Angle		$2\theta_{1/2}$	30			°	
Peak Sensitivity Wavelength		λ_p		875		nm	
RxD_IrDA Output Voltage	Logic High	V_{OH}	$V_{CC}-0.5$		V_{CC}	V	$I_{OH} = -200 \mu A$, $E_I \leq 0.3 \mu W/cm^2$
	Logic Low	V_{OL}	0		0.4	V	
RxD_IrDA Pulse Width (SIR) [2]		$t_{RPW(SIR)}$	1		4	μs	$\theta_{1/2} \leq 15^\circ$, $C_L = 9pF$
RxD_IrDA Rise & Fall Times		t_r, t_f		60		ns	$C_L = 9pF$
Receiver Latency Time [3]		t_L			200	μs	$E_I = 4.0 \mu W/cm^2$
Receiver Wake Up Time [4]		t_{RW}			200	μs	$E_I = 10 mW/cm^2$
Transmitter (IrDA Mode)							
IR Radiant Intensity		I_{EH}	4	19		mW/sr	$I_{LEDA} = 40mA$, $TxD_IR \geq V_{IH}$, $T_A = 25^\circ C$
IR Viewing Angle		$2\theta_{1/2}$	30		60	°	
IR Peak Wavelength		λ_p		885		nm	
TxD_IrDA Logic Levels	High	V_{IH-IR}	$V_{CC}-0.5$		V_{CC}	V	
	Low	V_{IL-IR}	0		0.5	V	
TxD_IrDA Input Current	High	I_{H-IR}		0.01	1	μA	$V_I \geq V_{IH}$
	Low	I_{L-IR}		2	10	μA	$0 \leq V_I \leq V_{IL}$
LED Current	Shutdown	I_{VLED}		0.01	10	μA	$V_{SD} \geq V_{H-SD}$
Wake Up Time [5]		t_{TW}		0.2	10	μs	
Maximum Optical Pulse Width [6]		$t_{PW(Max)}$		50	120	μs	
TXD Pulse Width (SIR)		$t_{PW(SIR)}$		1.6		μs	$t_{PW(TXD_IR)} = 1.6 \mu s$ at 115.2 kbit/s
TxD Rise & Fall Times (Optical)		t_r, t_f			600	ns	$t_{PW(TXD_IR)} = 1.6 \mu s$ at 115.2 kbit/s
LED Anode On-State Voltage		$V_{ON (LEDA)}$		2.8		V	$I_{LEDA} = 40mA$, $V_{I(TxD)} \geq V_{IH}$
Transmitter (Remote Control Mode)							
RC Radiant Intensity		I_{EH}		70		mW/sr	$I_{LEDA} = 150mA$, $\theta_{1/2} \leq 15^\circ$, $TxD_RC \geq V_{IH}$, $T_A = 25^\circ C$
RC Viewing Angle		$2\theta_{1/2}$	30		60	°	
RC Peak Wavelength		λ_p		885		nm	
TxD_RC Logic Levels	High	V_{IH}	$V_{CC}-0.5$		V_{CC}	V	
	Low	V_{IL}	0		0.5	V	
TxD_RC Input Current	High	I_H		0.01	1	μA	$V_I \geq V_{IH}$
	Low	I_L		2	10	μA	$0 \leq V_I \leq V_{IL}$
Maximum Optical Pulse Width [8]		$t_{PW(Max)}$		60		μs	
LED Anode On-State Voltage		$V_{ON (LEDA)}$		1.9		V	$I_{LEDA} = 150mA$, $V_{I(TxD)} \geq V_{IH}$

Transceiver

Parameters		Symbol	Min.	Typ.	Max.	Units	Conditions
Logic Input Voltage for SD		Logic High	VIH-SD				
		Vcc-0.5		Vcc	V		
		Logic Low	VIL-SD				
		0		0.4	V		
Supply Current	Shutdown	ICC1		0.03	1	μA	Vsd ≥ 1.5V
	Idle (Standby)	ICC2		60	80	μA	VI(TxD) ≤ VIL, EI=0
	Active	ICC3		350		μA	VI(TxD) ≥ VIL, EI=10mW/cm2

Note:

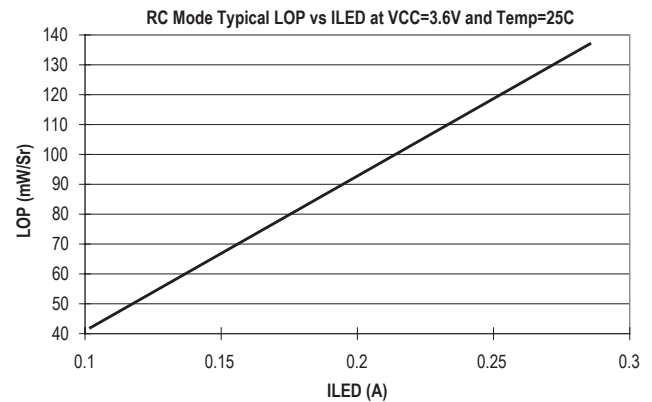
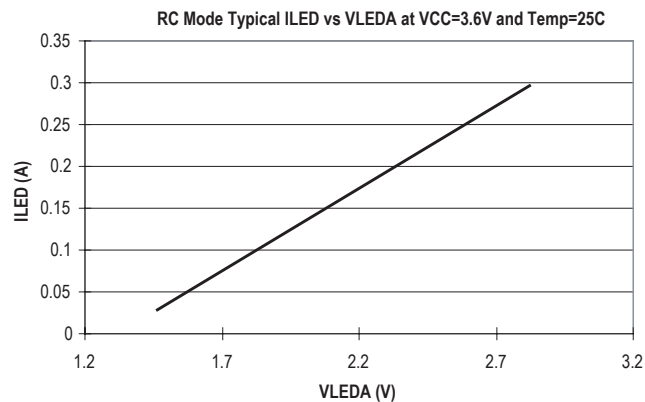
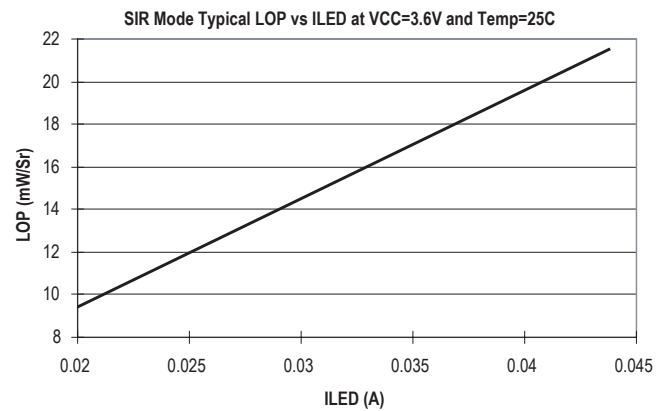
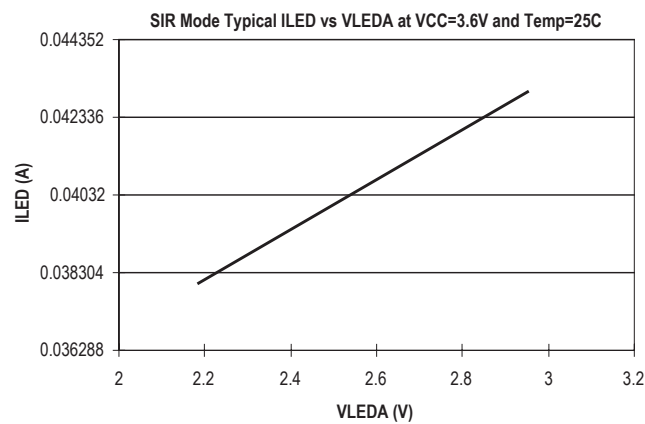
[2] For in-band signals 9.6 kbit/s to 115.2 kbit/s where $3.6 \mu\text{W}/\text{cm}^2 \leq \text{EI} \leq 500 \text{ mW}/\text{cm}^2$.

[3] Latency is defined as the time from the last TxD_IrDA light output pulse until the receiver has recovered full sensitivity.

[4] Receiver Wake Up Time is measured from Vcc power ON to valid RxD_IrDA output.

[5] Transmitter Wake Up Time is measured from Vcc power ON to valid light output in response to a TxD_IrDA pulse.

[6] The Optical PW is defined as the maximum time which the LED will turn on. This is to prevent the long turn on time for the LED.

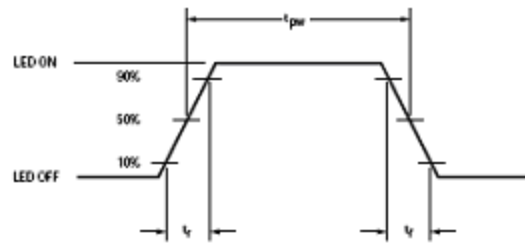


Timing Diagram

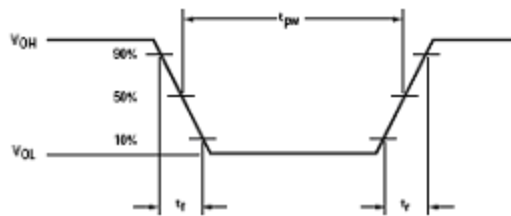
TXD "Stuck ON" Protection



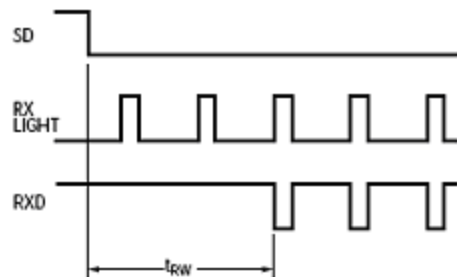
LED Optical Waveform



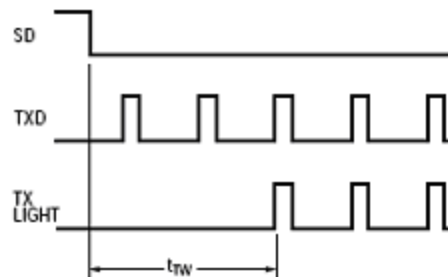
RXD Output Waveform



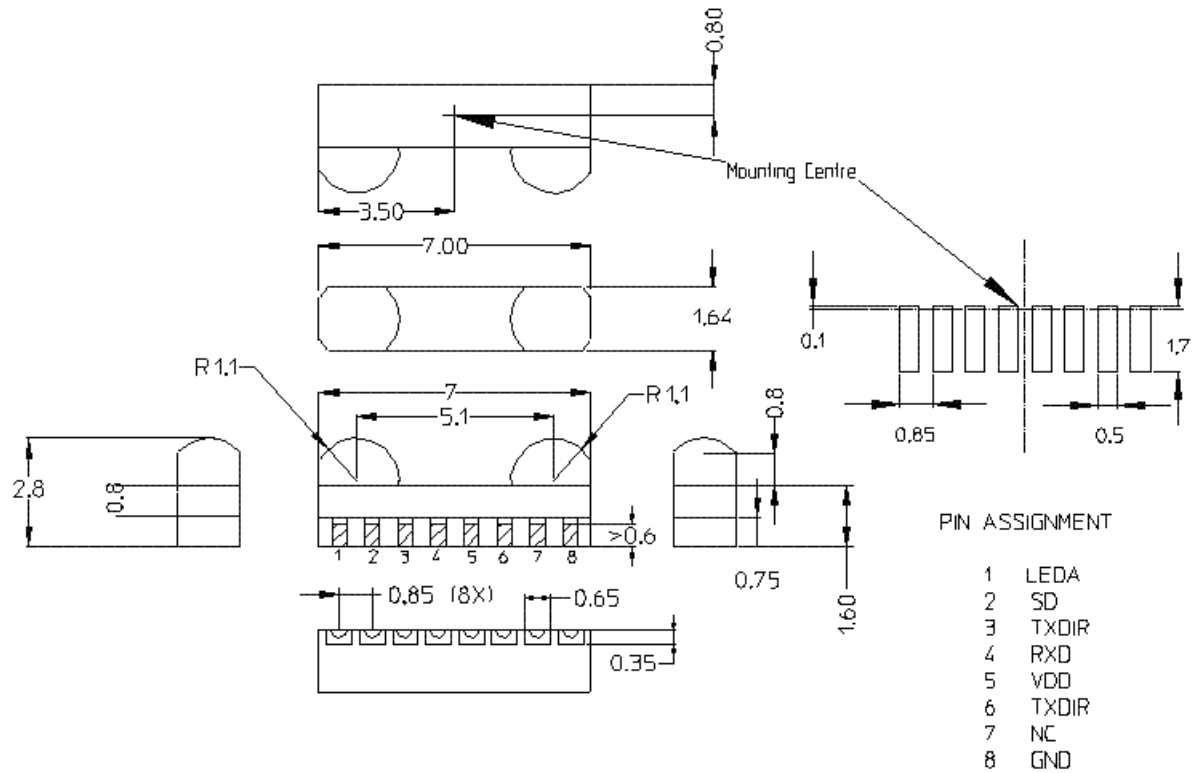
Receiver wakeup time waveform



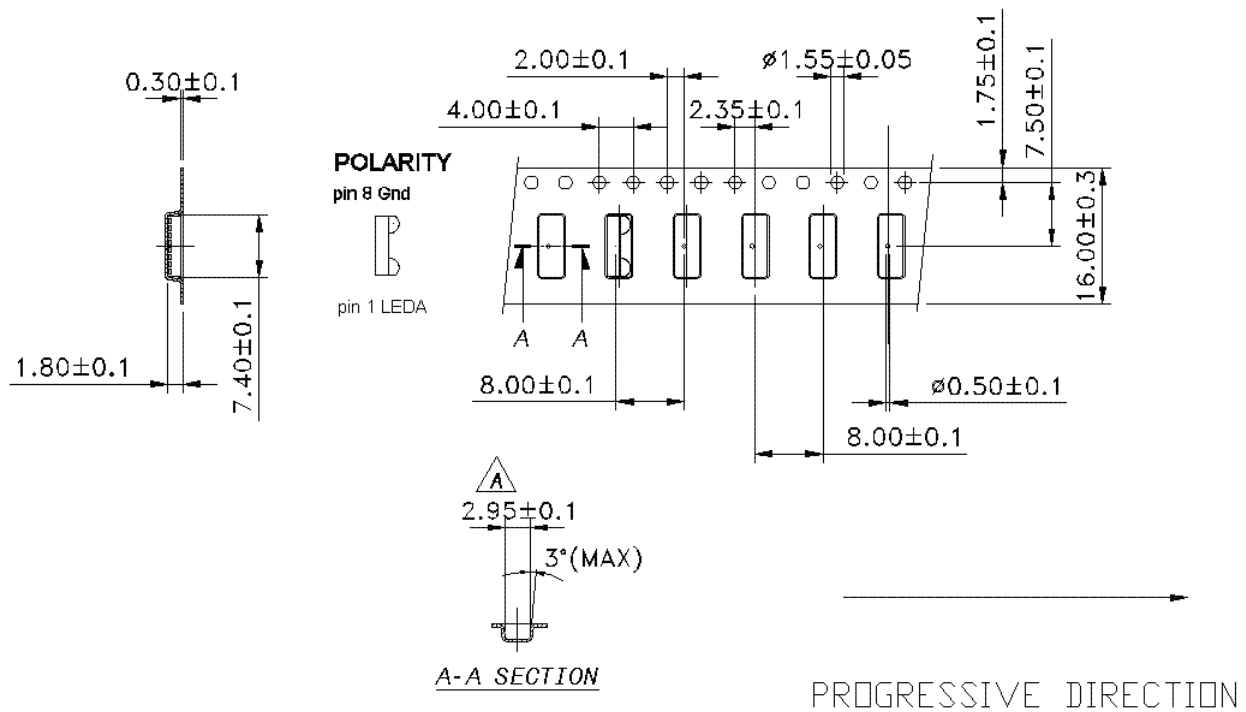
TXD wakeup time waveform



Package Dimension



Tape and Reel Dimensions

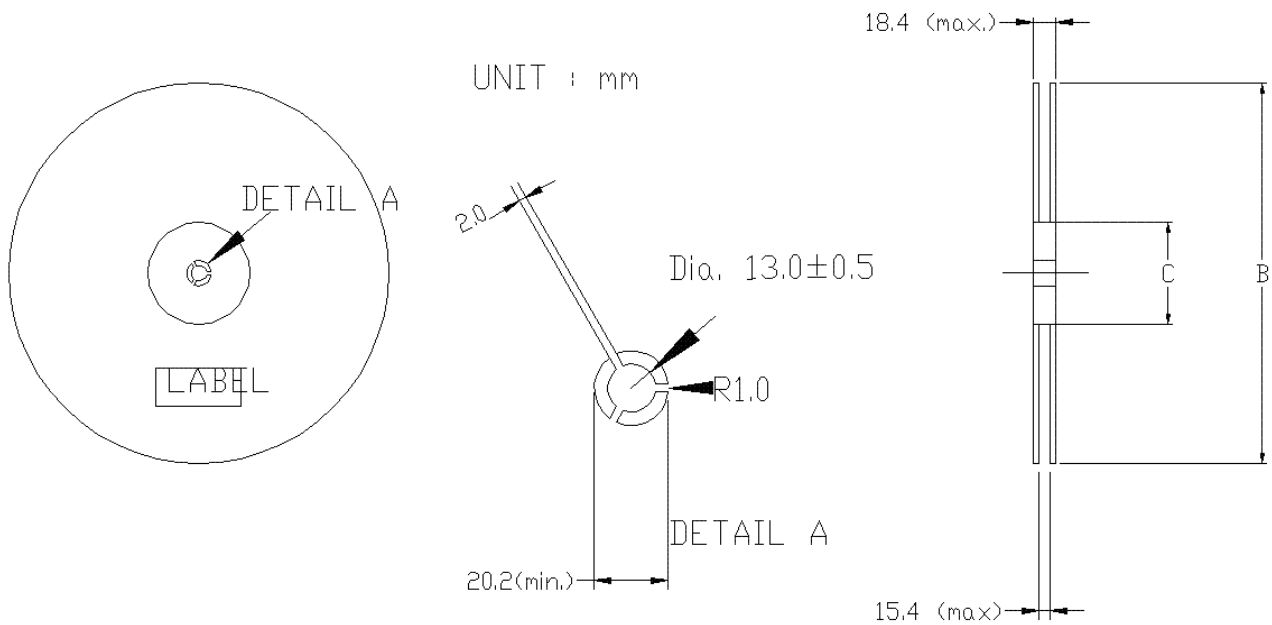
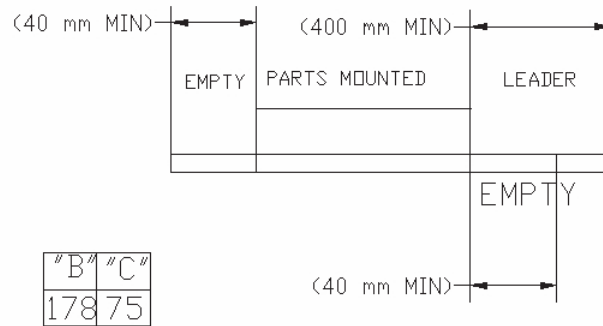


Tape and Reel Dimensions (Cont.)

Material of Carrier Tape : Conductive Polystyrene

Material of Cover Tape : PVC

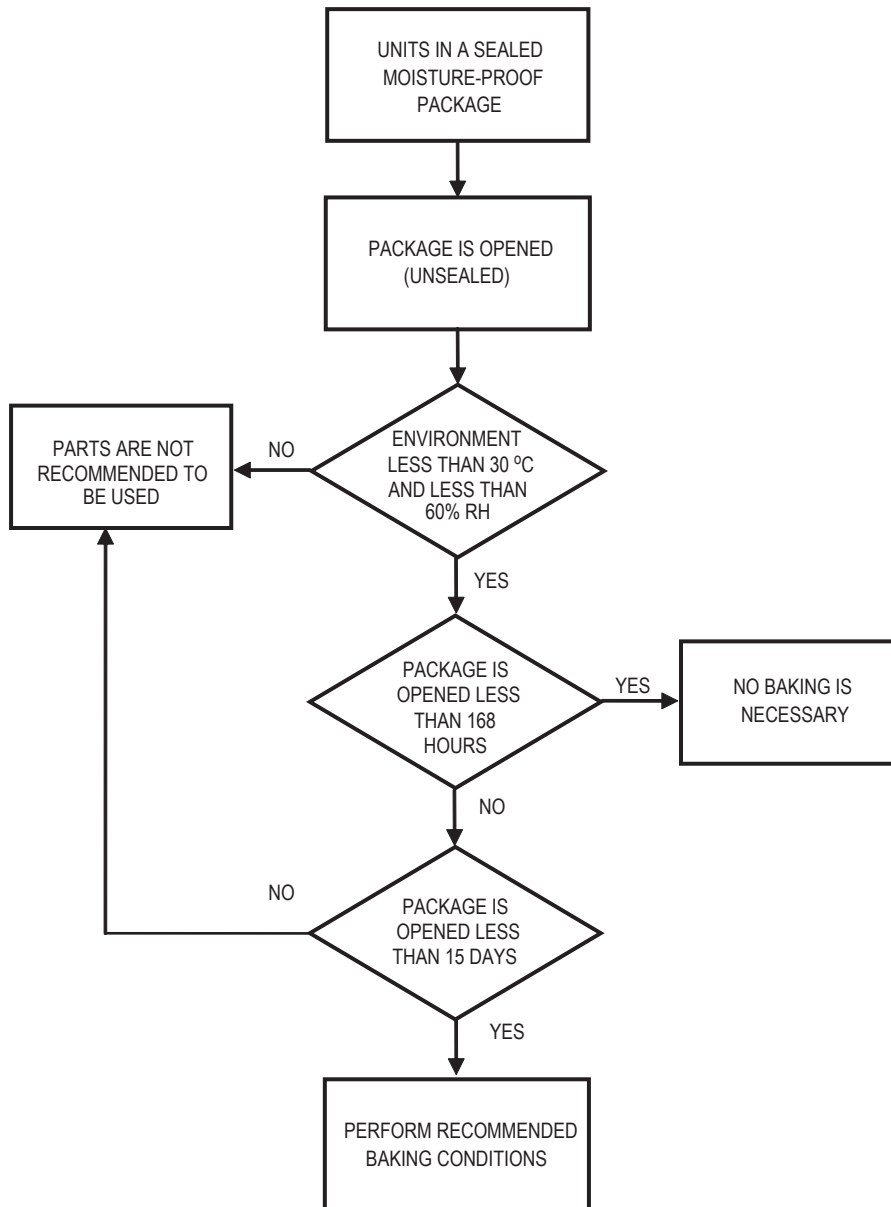
Method of Cover : Heat Sensitive Adhesive



ASDL-3007 Moisture Proof Packaging

All ASDL-3007 options are shipped in moisture proof package. Once opened, moisture absorption begins.

This part is compliant to JEDEC Level 3.



Baking Conditions Chart

Recommended Storage Conditions	
Storage Temperature	10 °C to 30 °C
Relative Humidity	Below 60% RH

Time from unsealing to soldering

After removal from the bag, the parts should be soldered within 7 days if stored at the recommended storage conditions. When MBB (Moisture Barrier Bag) is opened and the parts are exposed to the recommended storage conditions more than 7 days but less than 15 days the parts must be baked before reflow to prevent damage to the parts.

Note: To use the parts that exposed for more than 15 days is not recommended.

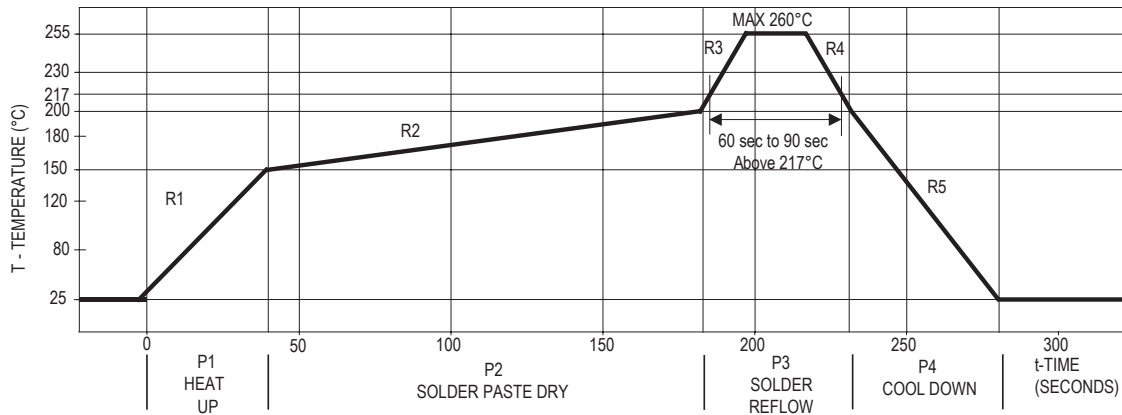
Baking Conditions

If the parts are not stored per the recommended storage conditions they must be baked before reflow to prevent damage to the parts.

Package	Temp	Time
In reels	60 °C	≥ 48hours
In bulk	100 °C	≥ 4hours

Note: Baking should only be done once.

Recommended Reflow Profile



Process Zones	Symbol	ΔT	Maximum $\Delta T/\Delta \text{time}$ or Duration
Heat Up	P1, R1	25°C to 150°C	3°C/s
Solder Paste Dry	P2, R2	150°C to 200°C	100s to 180s
Solder Reflow	P3, R3	200°C to 260°C	3°C/s
	P3, R4	260°C to 200°C	-6°C/s
Cool Down	P4, R5	200°C to 25°C	-6°C/s
Time maintained above liquidus point, 217°C		> 217°C	60s to 90s
Peak Temperature		260°C	-
Time within 5°C of actual Peak Temperature		-	20s to 40s
Time 25°C to Peak Temperature		25°C to 260°C	8mins

The reflow profile is a straight-line representation of a nominal temperature profile for a convective reflow solder process. The temperature profile is divided into four process zones, each with different $\Delta T/\Delta \text{time}$ temperature change rates or duration. The $\Delta T/\Delta \text{time}$ rates or duration are detailed in the above table. The temperatures are measured at the component to printed circuit board connections.

In process zone P1, the PC board and ASDL-3007 pins are heated to a temperature of 150°C to activate the flux in the solder paste. The temperature ramp up rate, R1, is limited to 3°C per second to allow for even heating of both the PC board and ASDL-3007 pins.

Process zone P2 should be of sufficient time duration (100 to 180 seconds) to dry the solder paste. The temperature is raised to a level just below the liquidus point of the solder.

Process zone P3 is the solder reflow zone. In zone P3, the temperature is quickly raised above the liquidus point of solder to 260°C (500°F) for optimum results. The dwell time above the liquidus point of solder should be between 60 and 90 seconds. This is to assure proper coalescing of the solder paste into liquid solder and the formation of good solder connections. Beyond the recommended dwell time the intermetallic growth within the solder connections becomes excessive, resulting in the formation of weak and unreliable connections. The temperature is then rapidly reduced to a point below the solidus temperature of the solder to allow the solder within the connections to freeze solid.

Process zone P4 is the cool down after solder freeze. The cool down rate, R5, from the liquidus point of the solder to 25°C (77°F) should not exceed 6°C per second maximum. This limitation is necessary to allow the PC board and ASDL-3007 pins to change dimensions evenly, putting minimal stresses on the ASDL-3007.

It is recommended to perform reflow soldering no more than twice.

Appendix A: ASDL-3007 SMT Assembly Application Note

Solder Pad, Mask and Metal Stencil

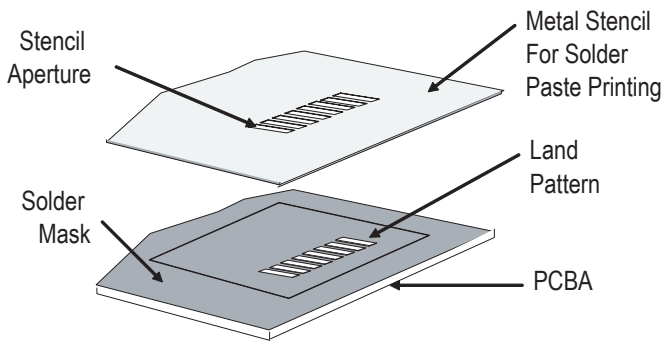


Figure A1. Stencil and PCBA

Recommended land pattern

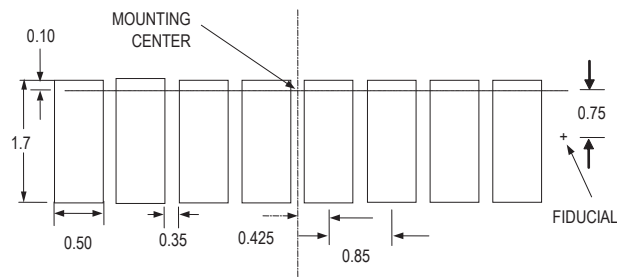


Figure A2. Recommended Land Pattern

Recommended Metal solder Stencil Aperture

It is recommended that a 0.127 mm (0.005 inch) thick stencil be used for solder paste printing. This is to ensure adequate printed solder paste volume and no shorting. See the Table 1 below the drawing for combinations of metal stencil aperture and metal stencil thickness that should be used.

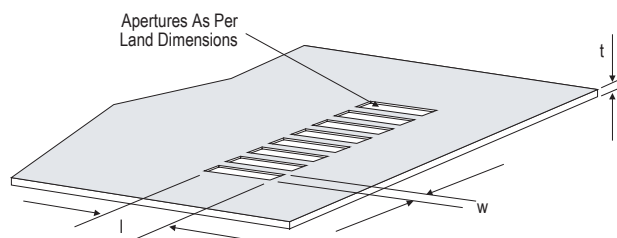


Figure A3. Solder stencil aperture

Table 1

Stencil thickness, t (mm)	Aperture size (mm)	
	Length, l	Width, w
0.127mm	1.7+/-0.05	0.5+/-0.05

Adjacent Land Keepout and Solder Mask Areas

Adjacent land keepout is the maximum space occupied by the unit relative to the land pattern. There should be no other SMD components within this area. The minimum solder resist strip width required to avoid solder bridging adjacent pads is 0.25mm. It is recommended that two fiducially crosses be placed at mid length of the pads for unit alignment.

Note: Wet/Liquid Photo-imaginable solder resist/mask is recommended

Dimension	mm
h	0.25
l	1.5
k	3.0
j	8.0

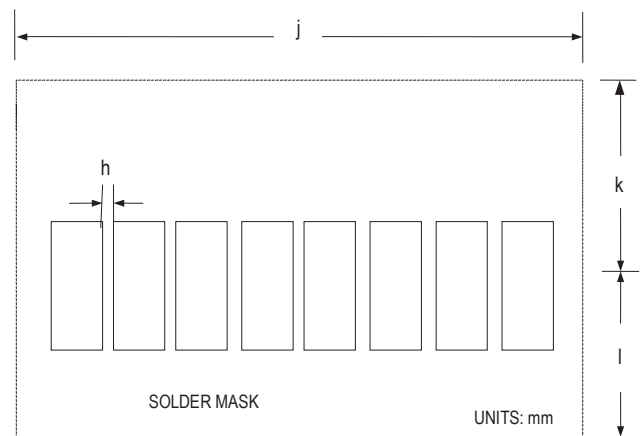


Figure A4. Adjacent Land Keepout and Solder Mask Area

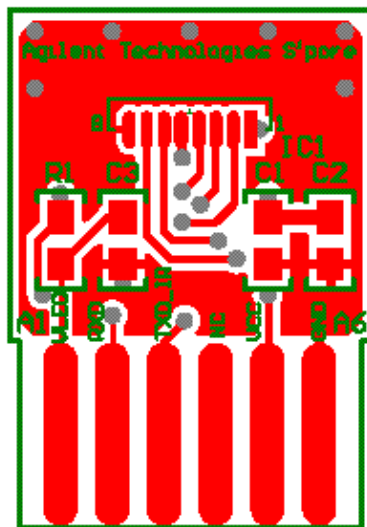
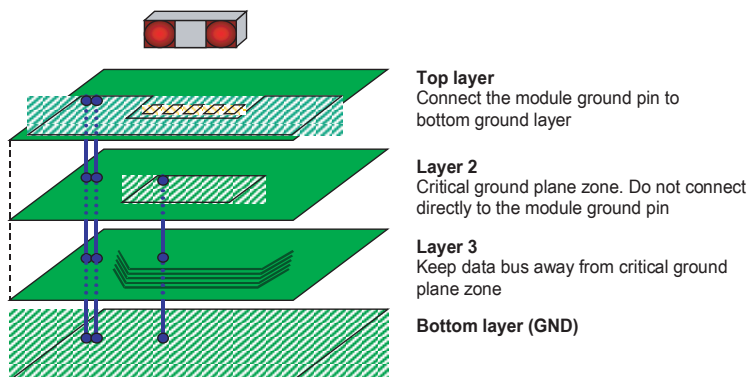
Appendix B: PCB Layout Suggestion

The ASDL-3007 is a shieldless part and hence does not contain a shield trace unlike the other transceivers. The effects of EMI and power supply noise can potentially reduce the sensitivity of the receiver, resulting in reduced link distance. The following PCB layout guidelines should be followed to obtain a good PSRR and EM immunity resulting in good electrical performance. Things to note:

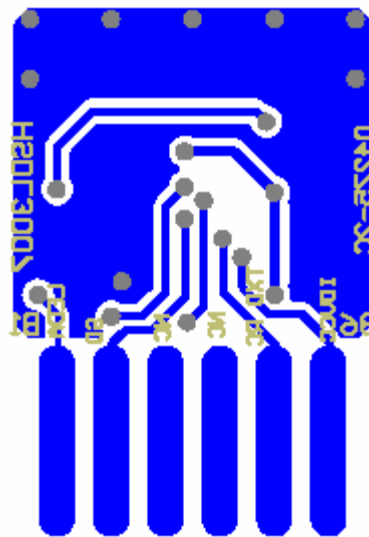
1. The ground plane should be continuous under the part.
2. VLED and Vcc can be connected to either unfiltered or unregulated power supply. If VLED and Vcc share the same power supply, CX3 need not be used. The connections for CX1 and CX2 should be connected before the current limiting resistor R1.

3. CX1 is generally a ceramic capacitor of low inductance providing a wide frequency response while CX2 and CX3 are tantalum capacitor of big volume and fast frequency response. The use of a tantalum capacitor is more critical on the VLED line, which carries a high current.
4. Preferably a multi-layered board should be used to provide sufficient ground plane. Use the layer underneath and near the transceiver module as Vcc, and sandwich that layer between ground connected board layers. The diagrams below demonstrate an example of a 4-layer board :

The area underneath the module at the second layer, and 3cm in all direction around the module is defined as the critical ground plane zone. The ground plane should be maximized in this zone. The layout below is based on a 2-layer PCB.



Top Layer



Bottom Layer

Appendix C: General Application Guide for the ASDL-3007 Infrared IrDA® Compliant 115.2kb/s Transceiver

Description

The ASDL-3007, a wide-voltage operating range infrared transceiver, is a low-cost and ultra small form factor device that is designed to address the mobile computing market such as PDAs, as well as small embedded mobile products such as digital cameras and cellular phones. It is spectrally suited to universal remote control transmission function. It is fully compliant to IrDA 1.4 low power specification from 9.6kb/s to 115.2kb/s, and support most remote control codes. The design of ASDL-3007 also includes the following unique features:

- Spectrally suited to universal remote control transmission function;
- Low passive component count;
- Shutdown mode for low power consumption requirement;

Selection of Resistor R1

Resistor R1 should be selected to provide the appropriate peak pulse LED current at different ranges of V_{CC} as shown on page 4 under "Recommended Application circuit components".

Interface to the Recommended I/O chip

The ASDL-3007's TXD data input is buffered to allow for CMOS drive levels. No peaking circuit or capacitor is required. Data rate from 9.6kb/s up to 115.2kb/s is available at RXD pin. The TXD_RC, pin6, is used to select the remote control transmit mode. Alternatively, the TXD_IR, pin3, is used for infrared transmit selection.

Figures C1 and C2 show how ASDL-3007 fits into a mobile phone and PDA platform respectively.

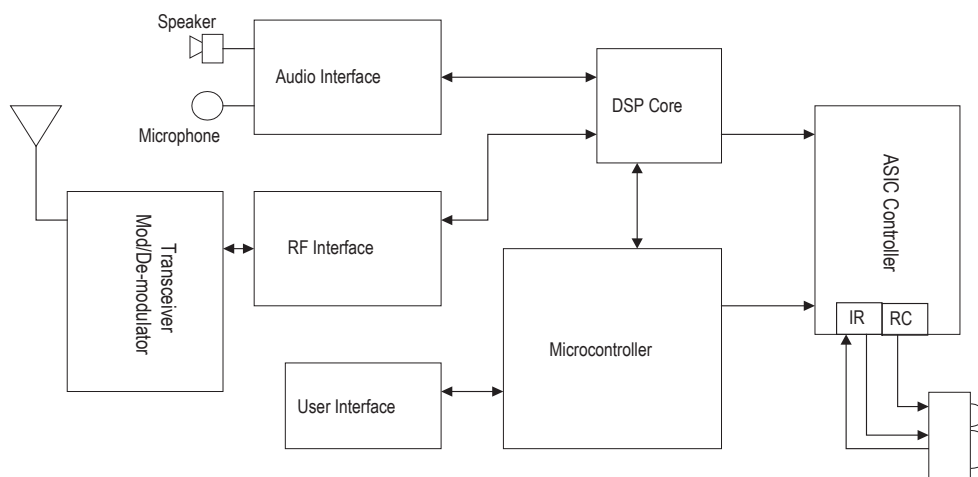


Figure C1. Mobile Application Platform

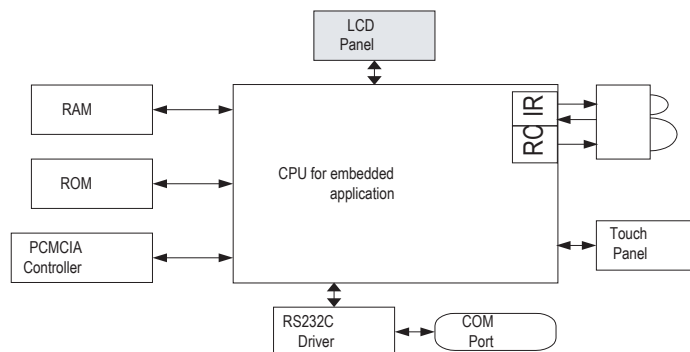


Figure C2. PDA Platform

Remote Control Operation

The ASDL-3007 is spectrally suited to universal remote control transmission function. Remote control applications are not governed by any standards, owing to which there are numerous remote codes in market. Each of those standards results in receiver modules with different sensitivities, depending on the carries frequencies and responsively to the incident light wavelength.

Figure C3 illustrate a reference interfacing circuit to implement both IrDA and RC functionality using ASDL-3007. The transceiver is directly interface with the micro-processor provided it has support for infrared commu-

nication commonly known as Infrared Communications Port (ICP). The remote control commands can be sent through one of the available General Purpose IO pins (GPIO). It is not recommended to turn on both IrDA data transmission and Remote control transmission simultaneously to prevent mixing and corruption of data. During IrDA data transmission, TxD_RC pin should be pull-down but not letting it floating. Same condition applied for Remote control transmission, which TxD_IR pin should not be left floating.

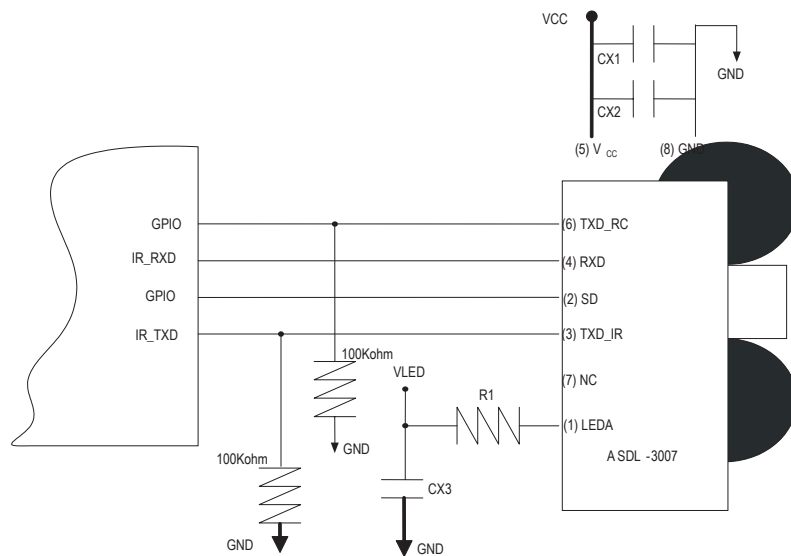


Figure C3. Reference design circuit for IrDA+RC transceiver

Appendix D: Window Design for ASDL-3007

Window Dimension

To ensure IrDA compliance, some constraints on the height and width of the window exist. The minimum dimensions ensure that the IrDA cones angles are met without vignetting. The maximum dimensions minimize the effects of stray light. The minimum size corresponds to a cone angle of 300 and the maximum size corresponds to a cone angle of 600.

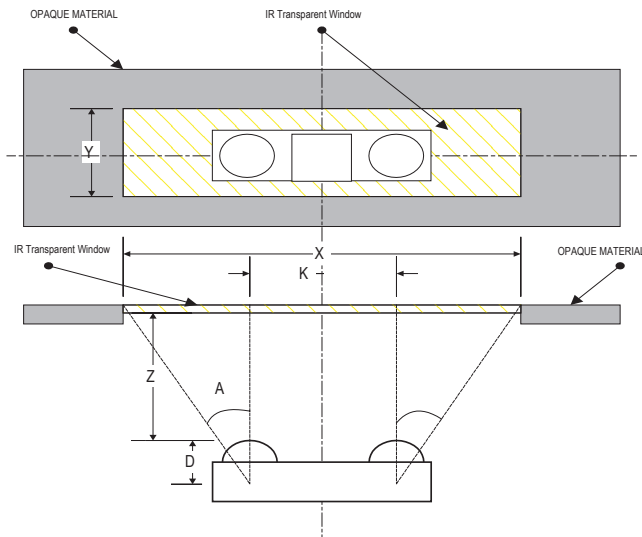


Figure D1. Window Design for ASDL-3007

In figure D1, X is the width of the window, Y is the height of the window and Z is the distance from the ASDL-3007 to the back of the window. The distance from the center of the LED lens to the center of the photodiode lens, K, is 5.1mm. The equations for computing the window dimensions are as follows:

$$X = K + 2 \cdot (Z + D) \cdot \tan A$$

$$Y = 2 \cdot (Z + D) \cdot \tan A$$

The above equations assume that the thickness of the window is negligible compared to the distance of the module from the back of the window (Z). If they are comparable, Z' replaces Z in the above equation. Z' is defined as

$$Z' = Z + t/n$$

where 't' is the thickness of the window and 'n' is the refractive index of the window material.

The depth of the LED image inside the ASDL-3007, D, is 4.32mm. 'A' is the required half angle for viewing. For IrDA compliance, the minimum is 150 and the maximum is 300. Assuming the thickness of the window to be negligible, the equations result in the following table and figures:

Module Depth (z) mm	Aperture Width (x, mm)		Aperture Height (y, mm)	
	Max	min	Max	Min
0	10.09	7.42	4.99	2.32
1	11.24	7.95	6.14	2.85
2	12.40	8.49	7.30	3.39
3	13.55	9.02	8.45	3.92
4	14.71	9.56	9.61	4.46
5	15.86	10.09	10.76	4.99
6	17.02	10.63	11.92	5.53
7	18.17	11.17	13.07	6.07
8	19.33	11.70	14.23	6.60
9	20.48	12.24	15.38	7.14

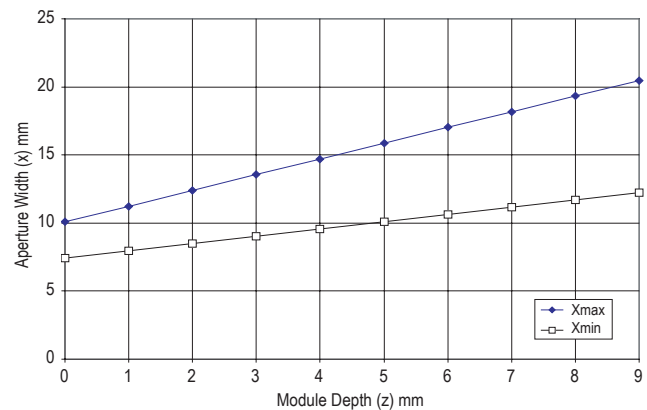


Figure D2. Aperture Height (x) vs. Module Depth (z)

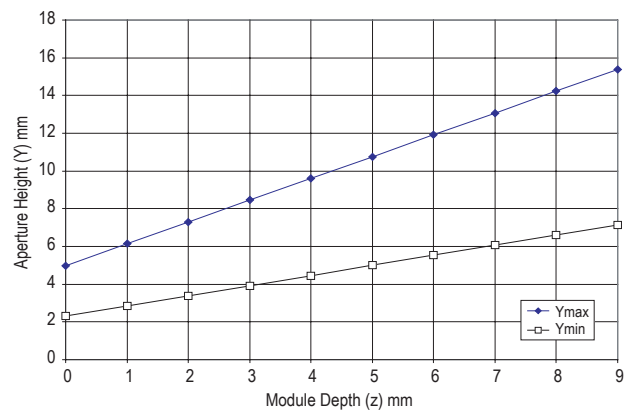


Figure D3. Aperture Height (y) vs. Module Depth (z)

The recommended minimum aperture width and height is based on the assumption that the center of the window and the center of the module are the same. It is recommended that the tolerance for assembly be considered as well. The minimum window size which will take into account of the assembly tolerance is defined as:

$$X (\text{min} + \text{assembly tolerance}) = X_{\text{min}} + 2 \cdot (\text{assembly tolerance}) \quad (\text{Dimensions are in mm})$$

$$Y (\text{min} + \text{assembly tolerance}) = Y_{\text{min}} + 2 \cdot (\text{assembly tolerance}) \quad (\text{Dimensions are in mm})$$

Window Material

Almost any plastic material will work as a window material. Polycarbonate is recommended. The surface finish of the plastic should be smooth, without any texture. An IR filter dye may be used in the window to make it look black to the eye, but the total optical loss of the window should be 10% or less for best optical performance. Light loss should be measured at 885 nm. The recommended plastic materials for use as a cosmetic window are available from General Electric Plastics.

Recommended Plastic Materials:

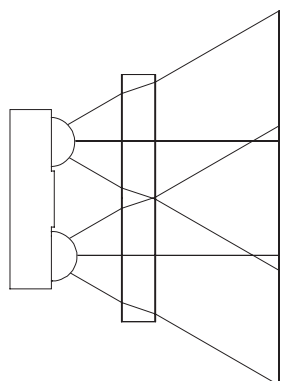
Material #	Light Transmission	Haze	Refractive Index
Lexan 141	88%	1%	1.586
Lexan 920A	85%	1%	1.586
Lexan 940A	85%	1%	1.586

Note: 920A and 940A are more flame retardant than 141.

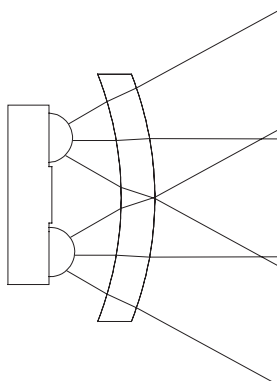
Recommended Dye: Violet #21051 (IR transmittant above 625nm)

Shape of the Window

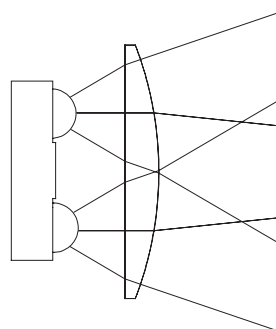
From an optics standpoint, the window should be flat. This ensures that the window will not alter either the radiation pattern of the LED, or the receive pattern of the photodiode. If the window must be curved for mechanical or industrial design reasons, place the same curve on the backside of the window that has an identical radius as the front side. While this will not completely eliminate the lens effect of the front curved surface, it will significantly reduce the effects. The amount of change in the radiation pattern is dependent upon the material chosen for the window, the radius of the front and back curves, and the distance from the back surface to the transceiver. Once these items are known, a lens design can be made which will eliminate the effect of the front surface curve. The following drawings show the effects of a curved window on the radiation pattern. In all cases, the center thickness of the window is 1.5 mm, the window is made of polycarbonate plastic, and the distance from the transceiver to the back surface of the window is 3 mm.



Flat Window
(First Choice)



Curved Front and Back
(Second Choice)



Curved Front, Flat Back
(Do not use)

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