

HSDL-3612

IrDA® Data Compliant 115.2 kb/s 3 V to 5 V Infrared Transceiver



Data Sheet

Description

The HSDL-3612 is a low-profile infrared transceiver module that provides interface between logic and IR signals for through-air, serial, half-duplex IR data link.

The module is compliant to IrDA Data Physical Layer Specifications 1.4 and IEC825-Class 1 Eye Safe.

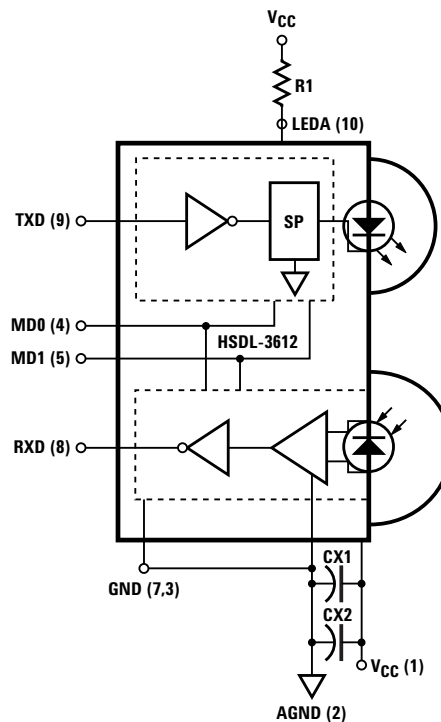
Applications

- Digital imaging
 - Digital still cameras
 - Photo-imaging printers
- Data communication
 - Notebook computers
 - Desktop PCs
 - Win CE handheld products
 - Personal Digital Assistants (PDAs)
 - Printers
 - Fax machines, photocopiers
 - Screen projectors
 - Auto PCs
 - Dongles
 - Set-Top box
- Telecommunication products
 - Cellular phones
 - Pagers
- Small industrial & medical instrumentation
 - General data collection devices
 - Patient & pharmaceutical data collection devices

Features

- Fully compliant to IrDA 1.0 physical layer specifications – 9.6 kb/s to 115.2 kb/s operation
- Typical link distance > 1.5 m
- IEC825-Class 1 eye safe
- Low power operation range – 2.7 V to 5.25 V
- Small module size – 4.0 x 12.2 x 5.1 mm (HxWxD)
- Complete shutdown – TXD, RXD, PIN diode
- Low shutdown current – 10 nA typical
- Adjustable optical power management – Adjustable LED drive-current to maintain link integrity
- Integrated EMI shield – Excellent noise immunity
- Edge detection input – Prevents the LED from long turn-on time
- Interface to various super I/O and controller devices
- Designed to accommodate light loss with cosmetic window
- Only 2 external components are required
- Lead free package

Functional Block Diagram



The HSDL-3612 contains a high-speed and high-efficiency 870 nm LED, a silicon PIN diode, and an integrated circuit. The IC contains an LED driver and a receiver providing a single output (RXD) for all data rates supported.

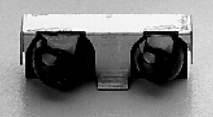
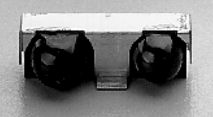
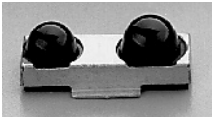

The HSDL-3612 can be completely shut down to achieve very low power consumption. In the shut down mode, the PIN diode will be inactive and thus producing very little photo-current even under very bright ambient light. The HSDL-3612 also incorporated the capability for adjustable optical power. With two programming pins; MODE 0 and MODE 1, the optical power output can be adjusted lower when the nominal desired link distance is one-third or two-third of the full IrDA link.

The HSDL-3612 front view options (HSDL-3612-007/-037) and a top view packaging option (HSDL-3612-008/-038) come with integrated shield that helps to ensure low EMI emission and high immunity to EMI field, thus enhancing reliable performance.

Application Support Information

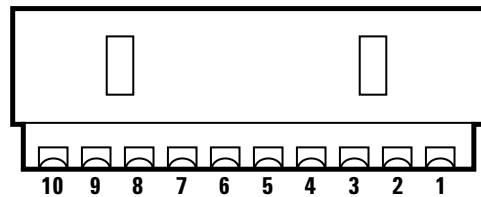
The Application Engineering group is available to assist you with the technical understanding associated with HSDL-3612 infrared transceiver module. You can contact them through your local sales representatives for additional details.

Ordering Information

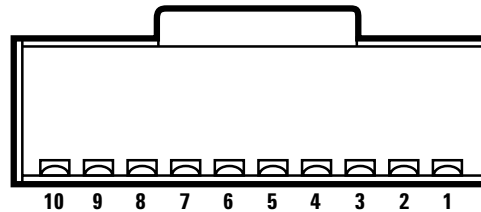
| Package Option | Package | Part Number | Standard Package Increment |
|---|------------|---------------|----------------------------|
|  | Front View | HSDL-3612-007 | 400 |
|  | Front View | HSDL-3612-037 | 1800 |
|  | Top View | HSDL-3612-008 | 400 |
|  | Top View | HSDL-3612-038 | 1800 |

I/O Pins Configuration Table

| Pin | Description | Symbol |
|-----|------------------------|-----------------|
| 1 | Supply Voltage | V _{CC} |
| 2 | Analog Ground | AGND |
| 3 | Ground | GND |
| 4 | Mode 0 | MD0 |
| 5 | Mode 1 | MD1 |
| 6 | No Connection | NC |
| 7 | Ground | GND |
| 8 | Receiver Data Output | RXD |
| 9 | Transmitter Data Input | TXD |
| 10 | LED Anode | LEDA |



BACK VIEW (HSDL-3612-007/-037)



BOTTOM VIEW (HSDL-3612-008/-038)

Transceiver Control Truth Table

| Mode 0 | Mode 1 | RX Function | TX Function |
|--------|--------|-------------|---------------------|
| 1 | 0 | Shutdown | Shutdown |
| 0 | 0 | SIR | Full Distance Power |
| 0 | 1 | SIR | 2/3 Distance Power |
| 1 | 1 | SIR | 1/3 Distance Power |

Transceiver I/O Truth Table

| Transceiver Mode | Inputs | | Outputs | |
|------------------|------------------|---------------------|-----------|--------------------|
| | TXD | EI | LED | RXD |
| Active | 1 | X | On | Not Valid |
| Active | 0 | High ^[1] | Off | Low ^[2] |
| Active | 0 | Low | Off | High |
| Shutdown | X ^[3] | Low | Not Valid | Not Valid |

X = Don't Care EI = In-Band Infrared Intensity at detector

Notes:

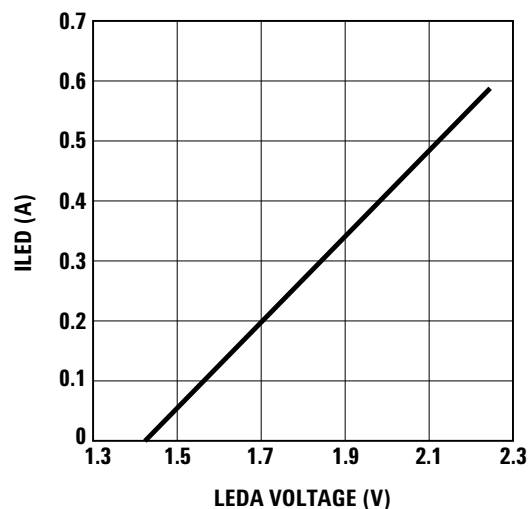
1. In-Band EI ≤ 115.2 kb/s.
2. Logic Low is a pulsed response. The condition is maintained for duration dependent on the pattern and strength of the incident intensity.
3. To maintain low shutdown current, TXD needs to be driven high or low and not left floating.

Recommended Application Circuit Components

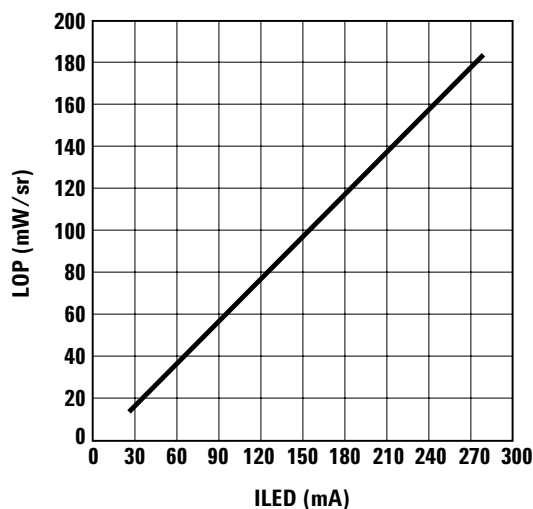
| Component | Recommended Value |
|--------------------|---|
| R1 | 6.2 $\Omega \pm 5\%$, 0.5 Watt, for $2.7 \leq V_{CC} \leq 3.6$ V operation 15.0 $\Omega \pm 5\%$, 0.5 Watt, for $4.75 \leq V_{CC} \leq 5.25$ V operation |
| CX1 ^[4] | 0.47 $\mu\text{F} \pm 20\%$, X7R Ceramic |
| CX2 ^[5] | 6.8 $\mu\text{F} \pm 20\%$, Tantalum |

Notes:

- CX1 must be placed within 0.7 cm of the HSDL-3612 to obtain optimum noise immunity.
- In "HSDL-3612 Functional Block Diagram" on page 1 it is assumed that V_{LED} and V_{CC} share the same supply voltage and filter capacitors. In case the 2 pins are powered by different supplies CX2 is applicable for V_{LED} and CX1 for V_{CC} . In environments with noisy power supplies, including CX2 on the V_{CC} line can enhance supply rejection performance.



ILED vs. LEDA.



Light Output Power (LOP) vs. ILED.

Marking Information

The HSDL-3612-007/-037 is marked "3612YYWW" on the shield where "YY" indicates the unit's manufacturing year, and "WW" refers to the work week in which the unit is tested.

CAUTIONS: The BiCMOS 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.

Absolute Maximum Ratings^[6]

| Parameter | Symbol | Minimum | Maximum | Unit | Conditions |
|-----------------------------------|----------------------|---------|----------------------|------|---|
| Storage Temperature | T _S | -40 | +100 | °C | |
| Operating Temperature | T _A | -20 | +70 | °C | |
| DC LED Current | I _{LED(DC)} | | 165 | mA | |
| Peak LED Current | I _{LED(PK)} | | 750 | mA | ≤ 2 μs pulse width, ≤ 10% duty cycle |
| LED Anode Voltage | V _{LEDA} | -0.5 | 7 | V | |
| Supply Voltage | V _{CC} | 0 | 7 | V | |
| Transmitter Data Input Current | I _{TXD(DC)} | -12 | 12 | mA | |
| Receiver Data Output Voltage | V _O | -0.5 | V _{CC} +0.5 | V | I _{O(RXD)} = 20 μA |

Note:

6. For implementations where case to ambient thermal resistance ≤ 50°C/W.

Recommended Operating Conditions

| Parameter | Symbol | Minimum | Maximum | Unit |
|--|-------------------|----------------------|--------------------|------|
| Operating Temperature | T _A | -20 | +70 | °C |
| Supply Voltage | V _{CC} | 2.7 | 5.25 | V |
| Logic High Input Voltage for TXD, MD0, MD1, and FIR_SEL | V _{IH} | 2 V _{CC} /3 | V _{CC} | V |
| Logic Low Transmitter Input Voltage | V _{IL} | 0 | V _{CC} /3 | V |
| LED (Logic High) Current Pulse Amplitude | I _{LEDA} | 180 | 300 | mA |
| Receiver Signal Rate | | 2.4 | 115.2 | kb/s |

Electrical & Optical Specifications

Specifications hold over the Recommended Operating Conditions unless otherwise noted. Unspecified test conditions can be anywhere in their operating range. All typical values are at 25°C and 3.3 V unless otherwise noted.

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions | |
|-------------------------------------|-----------------------------|--------------------------|------|------|---------------|--|---|
| Transceiver | | | | | | | |
| Supply Current | Shutdown | I_{CC1} | 10 | 200 | nA | $V_I(\text{TXD}) \leq V_{IL}$ or $V_I(\text{TXD}) \geq V_{IH}$ | |
| | Idle | I_{CC2} | 2.5 | 5 | mA | $V_I(\text{TXD}) \leq V_{IL}$, EI = 0 | |
| Digital Input Current | Logic Low/High | $I_{L/H}$ | -1 | 1 | μA | $0 \leq V_I \leq V_{CC}$ | |
| Transmitter | | | | | | | |
| Transmitter Radiant Intensity | Logic High Intensity | E_{IH} | 50 | 120 | 400 | mW/sr | $V_{IH} = 3.0\text{ V}$ $I_{LEDA} = 200\text{ mA}$ $\theta_{1/2} \leq 15^\circ$ |
| | Peak Wavelength | λ_P | | 875 | | nm | |
| | Spectral Line Half Width | $\Delta\lambda_{1/2}$ | | 35 | | nm | |
| | Viewing Angle | $2\theta_{1/2}$ | 30 | | 60 | ° | |
| | Optical Pulse Width | $tpw(EI)$ | 1.5 | 1.6 | 1.8 | μs | $tpw(\text{TXD}) = 1.6\ \mu\text{s}$ at 115.2 kb/s |
| | Rise and Fall Times | $t_r(EI)$, $t_f(EI)$ | | | 40 | ns | $tpw(\text{TXD}) = 1.6\ \mu\text{s}$ at 115.2 kb/s $t_{r/f}(\text{TXD}) = 10\text{ ns}$ |
| | Maximum Optical Pulse Width | $tpw(\text{max})$ | | 20 | 50 | μs | TXD pin stuck high |
| | LED Anode On State Voltage | $V_{ON}(\text{LEDA})$ | | | 2.4 | V | $I_{LEDA} = 200\text{ mA}$, $V_I(\text{TXD}) \geq V_{IH}$ |
| LED Anode Off State Leakage Current | $I_{LK}(\text{LEDA})$ | | 1 | 100 | nA | $V_{LEDA} = V_{CC} = 5.25\text{ V}$, $V_I(\text{TXD}) \leq V_{IL}$ | |

Electrical & Optical Specifications

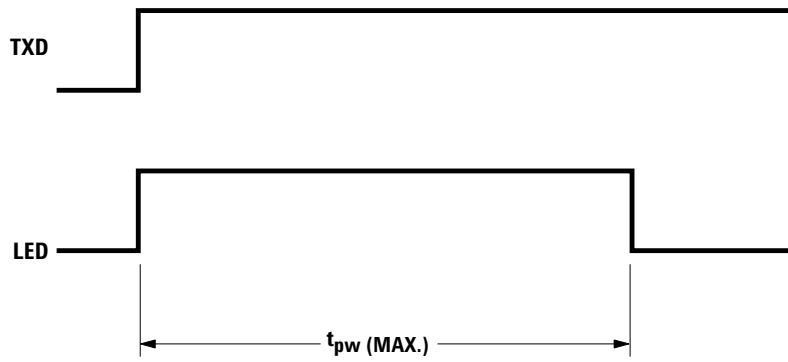
Specifications hold over the Recommended Operating Conditions unless otherwise noted. Unspecified test conditions can be anywhere in their operating range. All typical values are at 25°C and 3.3 V unless otherwise noted.

| | Parameter | Symbol | Min. | Typ. | Max. | Unit | Conditions |
|--------------------------------------|--------------------------|-----------------|----------------|------|----------|---------------------------|---|
| Receiver | | | | | | | |
| Receiver Data Output Voltage | Logic Low ^[7] | V_{OL} | 0 | - | 0.4 | V | $I_{OL} = 1.0 \text{ mA}$, $EI \geq 3.6 \text{ } \mu\text{W}/\text{cm}^2$, $\theta_{1/2} \leq 15^\circ$ |
| | Logic High | V_{OH} | $V_{CC} - 0.2$ | - | V_{CC} | V | $I_{OH} = -20 \text{ } \mu\text{A}$, $EI \leq 0.3 \text{ } \mu\text{W}/\text{cm}^2$, $\theta_{1/2} \leq 15^\circ$ |
| | Viewing Angle | $2\theta_{1/2}$ | 30 | | | ° | |
| Logic High Receiver Input Irradiance | E_{IH} | | 0.0036 | | 500 | mW/cm^2 | For in-band signals $\leq 115.2 \text{ kb/s}$ ^[8] |
| Logic Low Receiver Input Irradiance | E_{IL} | | | | 0.3 | $\mu\text{W}/\text{cm}^2$ | For in-band signals ^[8] |
| Receiver Peak Sensitivity Wavelength | λ_p | | | 880 | | nm | |
| Receiver SIR Pulse Width | tpw (SIR) | | 1 | | 4.0 | μs | $\theta_{1/2} \leq 15^\circ$ ^[9] , $C_L = 10 \text{ pF}$ |
| Receiver Latency Time | t_L | | | 20 | 50 | μs | |
| Receiver Rise/Fall Times | $t_{r/f}$ (RXD) | | | 25 | | ns | |
| Receiver Wake Up Time | t_W | | | | 100 | μs | ^[10] |

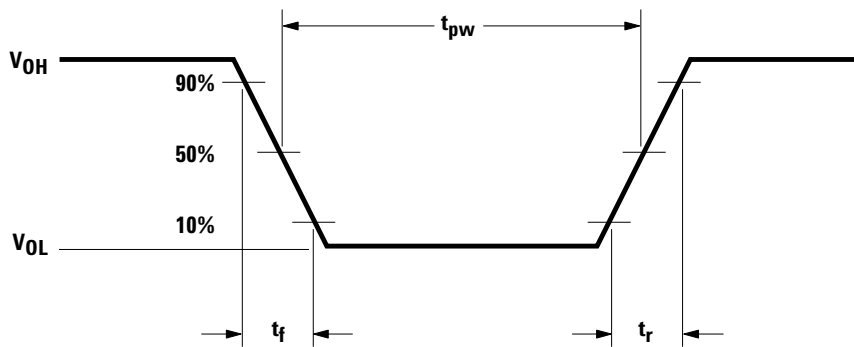
Notes:

7. Logic Low is a pulsed response. The condition is maintained for duration dependent on pattern and strength of the incident intensity.
8. An in-band optical signal is a pulse/sequence where the peak wavelength, λ_p , is defined as $850 \leq \lambda_p \leq 900 \text{ nm}$, and the pulse characteristics are compliant with the IrDA Serial Infrared Physical Layer Link Specification.
9. For in-band signals $\leq 115.2 \text{ kb/s}$ where $3.6 \text{ } \mu\text{W}/\text{cm}^2 \leq EI \leq 500 \text{ mW}/\text{cm}^2$.
10. Wake Up Time is the time between the transition from a shutdown state to an active state and the time when the receiver is active and ready to receive infrared signals.

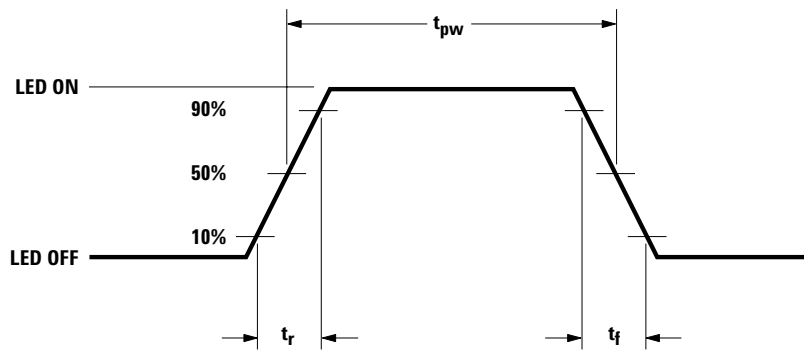
TXD "Stuck ON" Protection



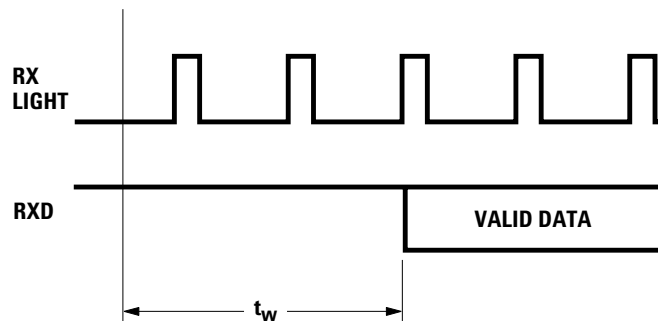
RXD Output Waveform



LED Optical Waveform

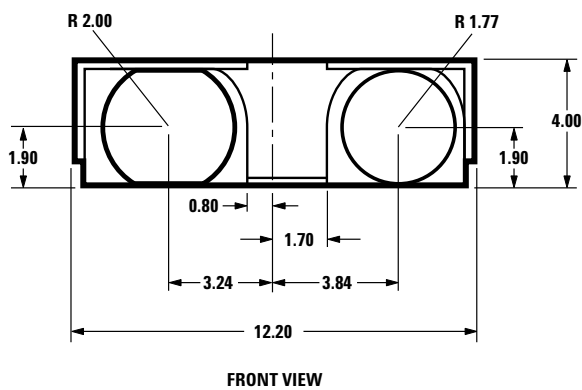
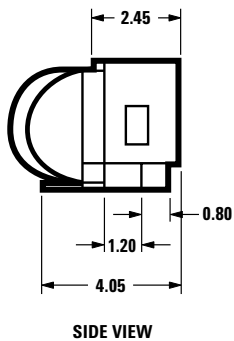
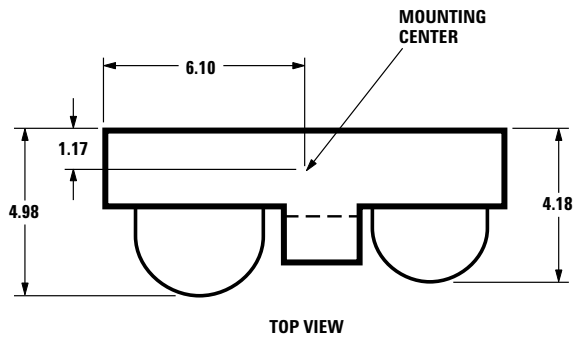


Receiver Wake Up Time Definition (when MD0 π 1 and MD1 π 0)

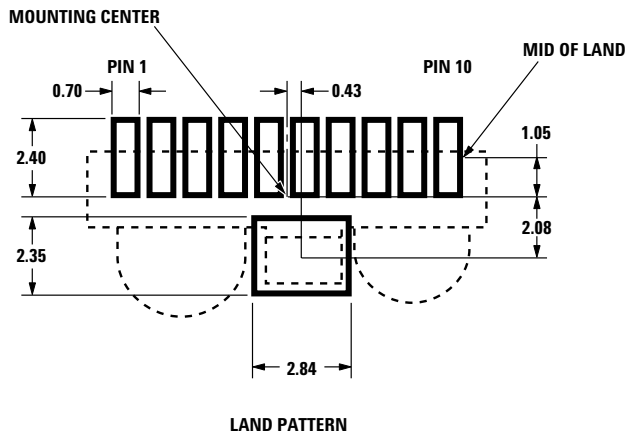
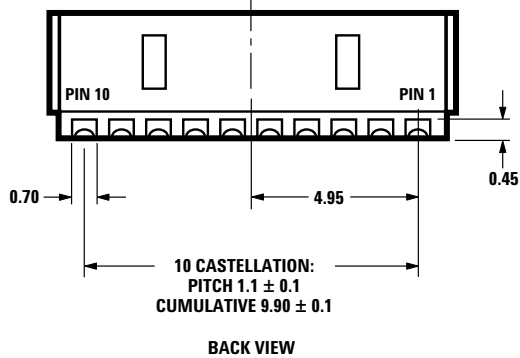


HSDL-3612-007 and HSDL3612-037 Package Outline with Dimension and Recommended PC Board Pad Layout

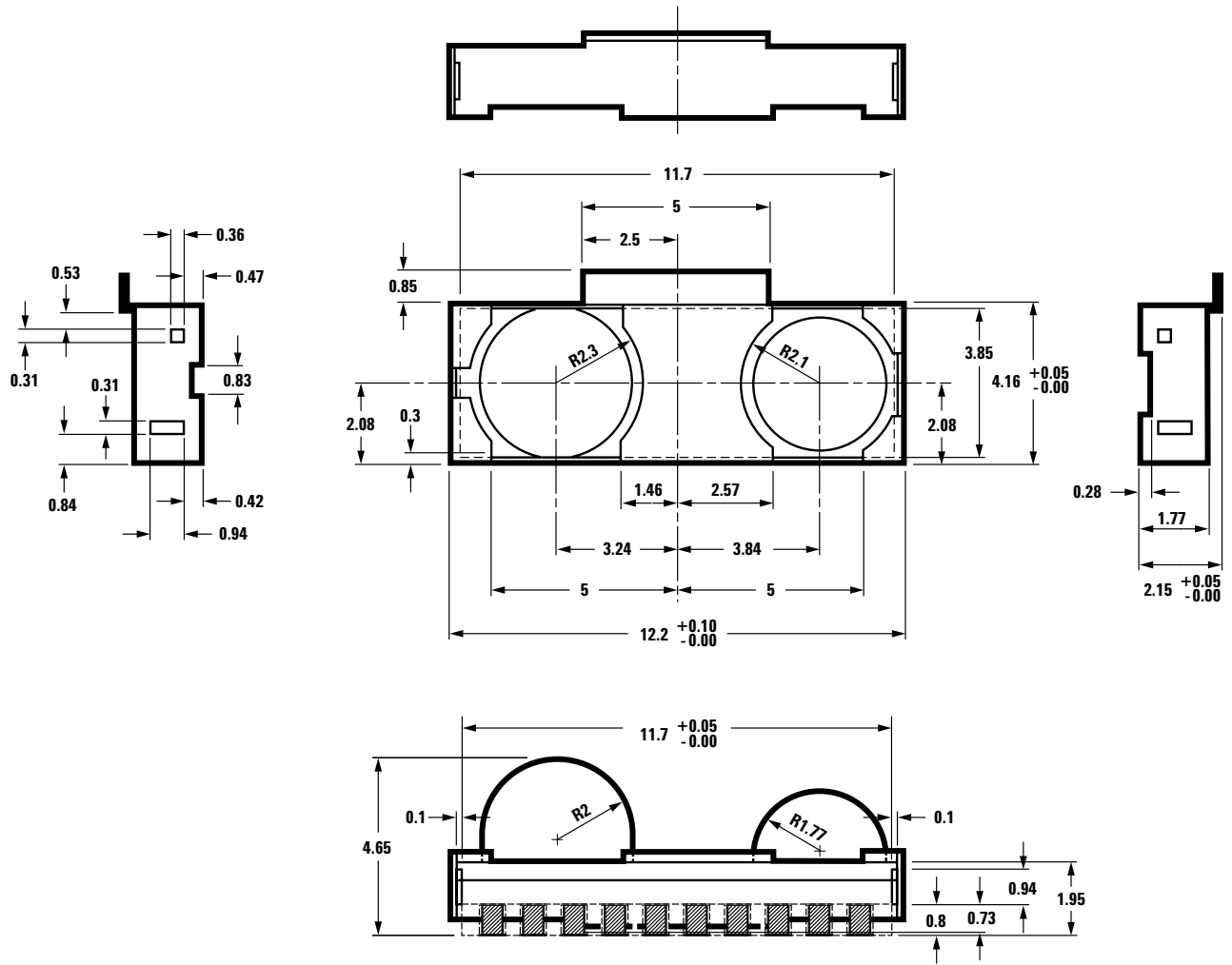
| PIN | FUNCTION | PIN | FUNCTION |
|-----|-----------------|-----|----------|
| 1 | V _{CC} | 6 | NC |
| 2 | AGND | 7 | GND |
| 3 | GND | 8 | RXD |
| 4 | MD0 | 9 | TXD |
| 5 | MD1 | 10 | LEDA |



ALL DIMENSIONS IN MILLIMETERS (mm).
DIMENSION TOLERANCE IS 0.20 mm
UNLESS OTHERWISE SPECIFIED.



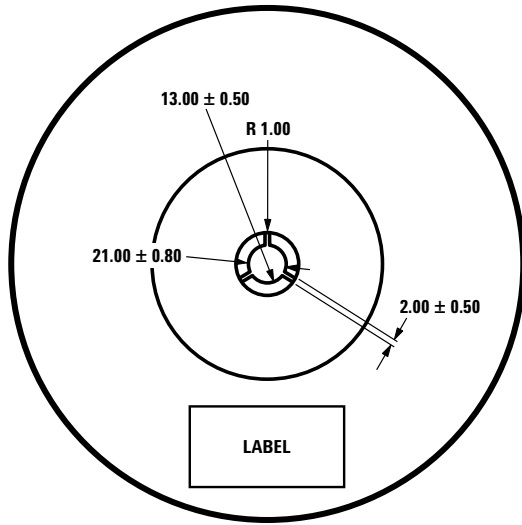
HSDL-3612-008 and HSDL3612-038 Package Outline with Dimension and Recommended PC Board Pad Layout



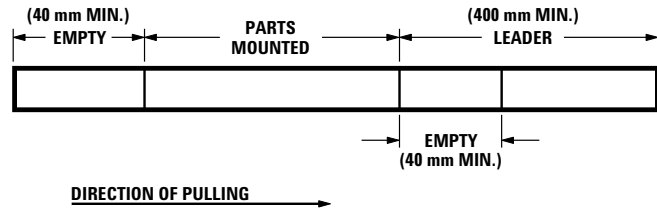
Tape and Reel Dimensions (HSDL-3612-007, -037)

ALL DIMENSIONS IN MILLIMETERS (mm)

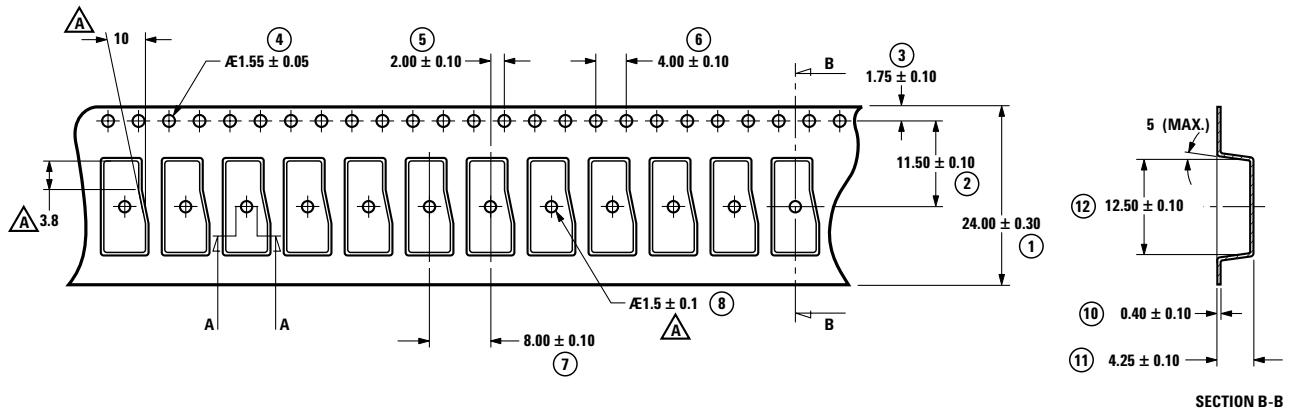
QUANTITY = 400 PIECES PER REEL (HSDL-3612-007)
1800 PIECES PER TAPE (HSDL-3612-037)



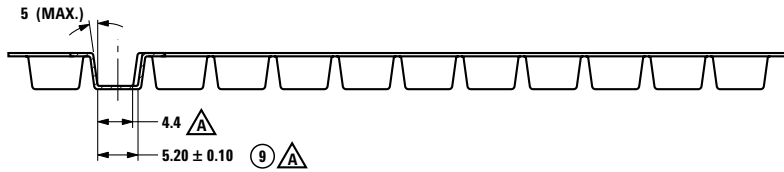
SHAPE AND DIMENSIONS OF REELS



CONFIGURATION OF TAPE



SECTION B-B

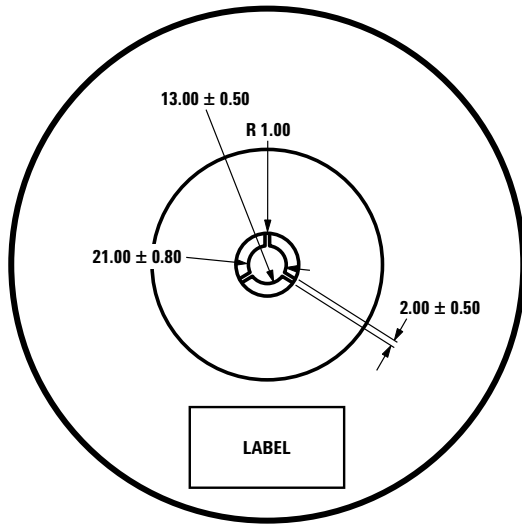


SECTION A-A

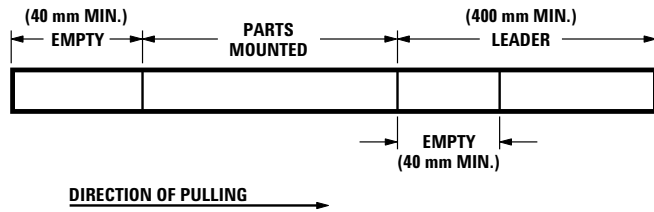
Tape and Reel Dimensions (HSDL-3612-008, -038)

ALL DIMENSIONS IN MILLIMETERS (mm)

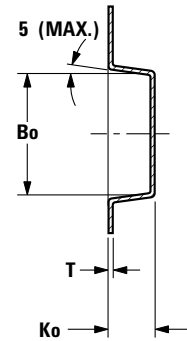
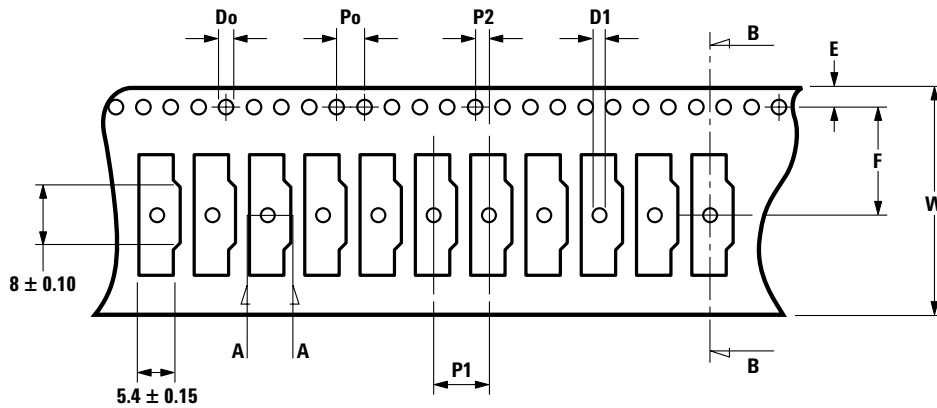
QUANTITY = 400 PIECES PER REEL (HSDL-3612-008)
1800 PIECES PER TAPE (HSDL-3612-038)



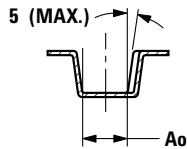
SHAPE AND DIMENSIONS OF REELS



CONFIGURATION OF TAPE



SECTION B-B



SECTION A-A

| | | | | | | | |
|--------|-------------|--------------|-------------|------------|------------|-------------|-------------|
| SYMBOL | Ao | Bo | Ko | Po | P1 | P2 | T |
| SPEC | 4.4 ± 0.10 | 12.50 ± 0.10 | 4.85 ± 0.10 | 4.0 ± 0.10 | 8.0 ± 0.10 | 2.0 ± 0.10 | 0.35 ± 0.10 |
| SYMBOL | E | F | Do | D1 | W | 10Po | |
| SPEC | 1.75 ± 0.10 | 11.5 ± 0.10 | 1.55 ± 0.10 | 1.5 ± 0.10 | 24.0 ± 0.3 | 40.0 ± 0.20 | |

NOTES:

1. I.D. sprocket hole pitch cumulative tolerance is ± 0.2 mm.
2. Corner camber shall be not more than 1 mm per 100 mm through a length of 250 mm.
3. Ao and Bo measured on a place 0.3 mm above the bottom of the pocket.
4. Ko measured from a place on the inside bottom of the pocket to top surface of carrier.
5. Pocket position relative to sprocket hole measured as true position of pocket, not pocket hole.

Moisture Proof Packaging

All HSDL-3612 options are shipped in moisture proof package. Once opened, moisture absorption begins.

Baking Conditions

If the parts are not stored in dry conditions, they must be baked before reflow to prevent damage to the parts.

| Package | Temp. | Time |
|----------|-------|------------|
| In reels | 60°C | ≥ 48 hours |
| In bulk | 100°C | ≥ 4 hours |
| | 125°C | ≥ 2 hours |
| | 150°C | ≥ 1 hour |

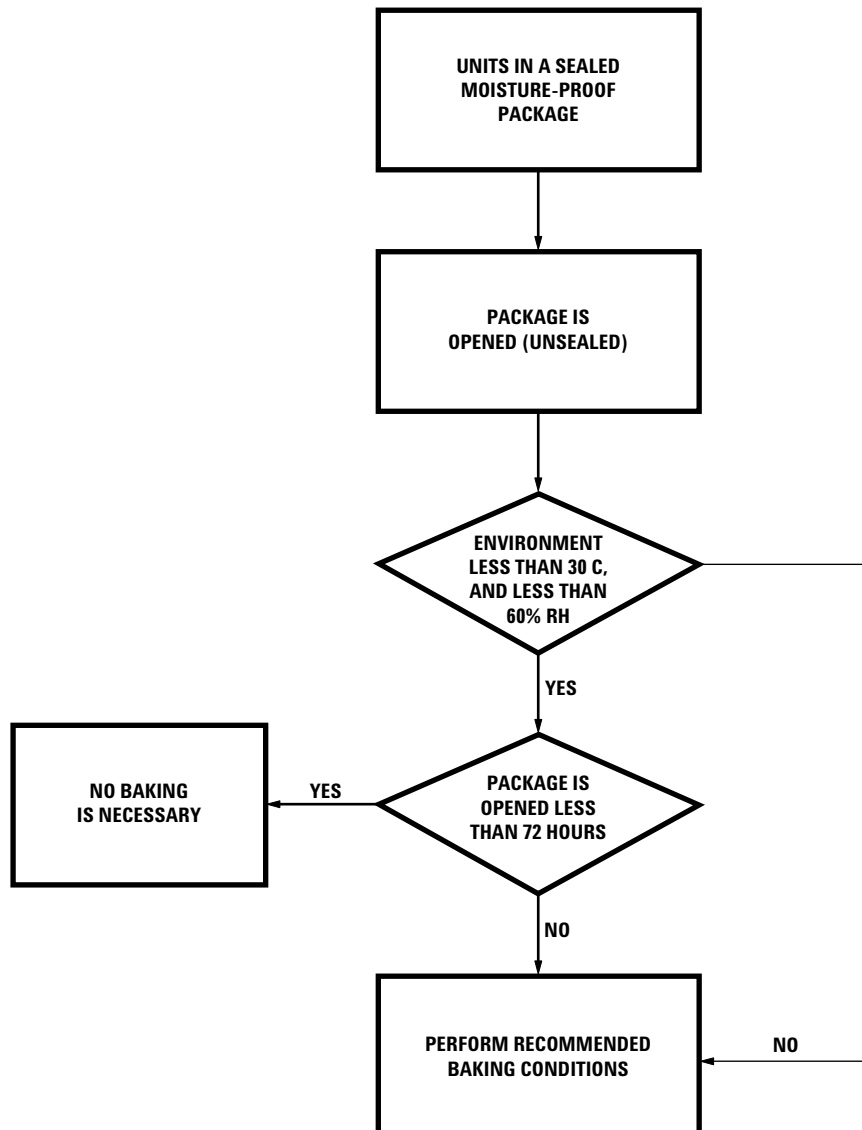
Baking should be done only once.

Recommended Storage Conditions

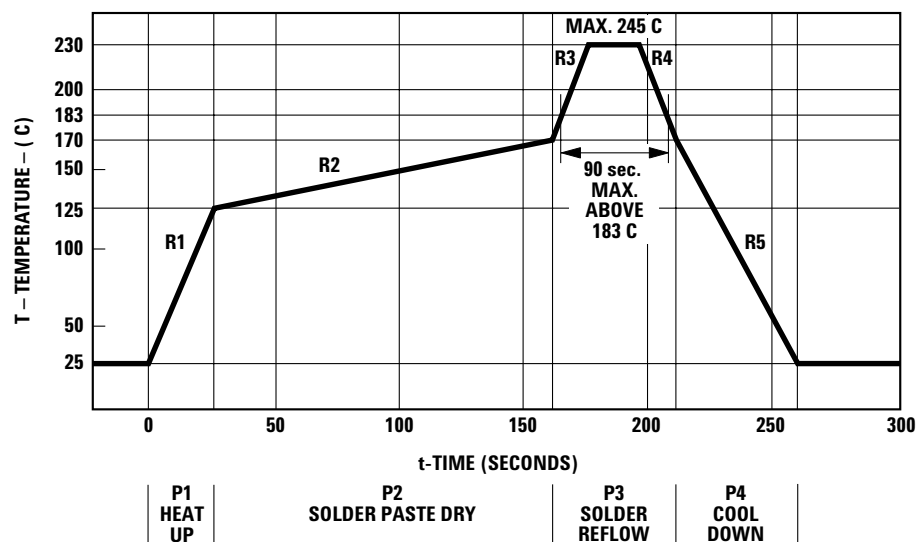
| | |
|---------------------|--------------|
| Storage Temperature | 10°C to 30°C |
| Relative Humidity | below 60% RH |

Time from Unsealing to Soldering

After removal from the bag, the parts should be soldered within three days if stored at the recommended storage conditions. If times longer than 72 hours are needed, the parts must be stored in a dry box.



Recommended Reflow Profile



| Process Zone | Symbol | ΔT | Maximum $\Delta T/\Delta \text{time}$ |
|------------------|--------|----------------------------|---------------------------------------|
| Heat Up | P1, R1 | 25°C to 160°C | 4°C/s |
| Solder Paste Dry | P2, R2 | 160°C to 200°C | 0.5°C/s |
| Solder Reflow | P3, R3 | 200°C to 255°C | 4°C/s |
| | | (260°C at 10 seconds max.) | |
| | P3, R4 | 255°C to 200°C | -6°C/s |
| Cool Down | P4, R5 | 200°C to 25°C | -6°C/s |

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. The $\Delta T/\Delta \text{time}$ rates 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 HSDL-3612 castellation pins are heated to a temperature of 160°C to activate the flux in the solder paste. The temperature ramp up rate, R1, is limited to 4°C per second to allow for even heating of both the PC board and HSDL-3612 castellations.

Process zone P2 should be of sufficient time duration (60 to 120 seconds) to dry the solder paste. The temperature is raised to a level just below the liquidus point of the solder, usually 200°C (392°F).

Process zone P3 is the solder reflow zone. In zone P3, the temperature is quickly raised above the liquidus point of solder to 255°C (491°F) for optimum results. The dwell time above the liquidus point of solder should be between 20 and 60 seconds. It usually takes about

20 seconds to assure proper coalescing of the solder balls into liquid solder and the formation of good solder connections. Beyond a dwell time of 60 seconds, 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, usually 200°C (392°F), 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 HSDL-3612 castellations to change dimensions evenly, putting minimal stresses on the HSDL-3612 transceiver.

Appendix A: HSDL-3612-007/-037 SMT Assembly Application Note

1.0 Solder Pad, Mask and Metal Solder Stencil Aperture

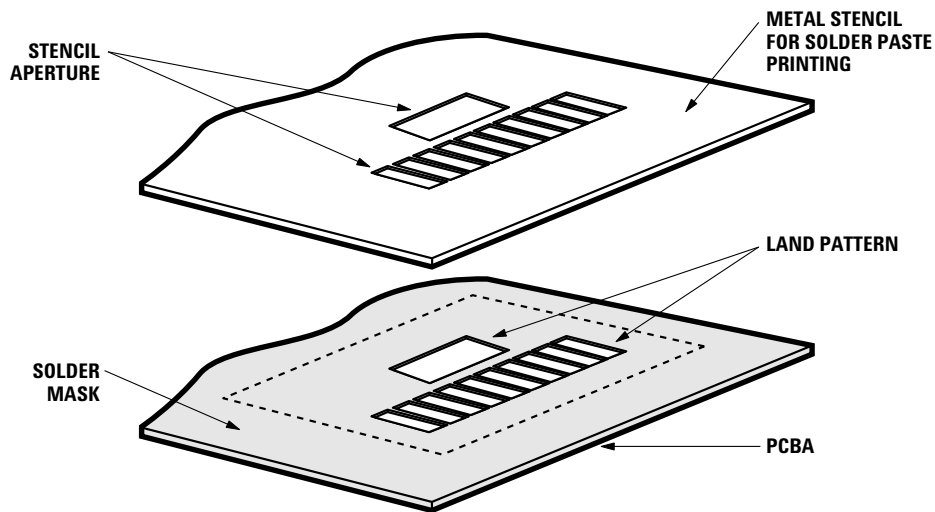


Figure 1.0. Stencil and PCBA.

1.1 Recommended Land Pattern for HSDL-3612-007/-037

| Dim. | mm | Inches |
|-----------|------|--------|
| a | 2.40 | 0.095 |
| b | 0.70 | 0.028 |
| c (pitch) | 1.10 | 0.043 |
| d | 2.35 | 0.093 |
| e | 2.80 | 0.110 |
| f | 3.13 | 0.123 |
| g | 4.31 | 0.170 |

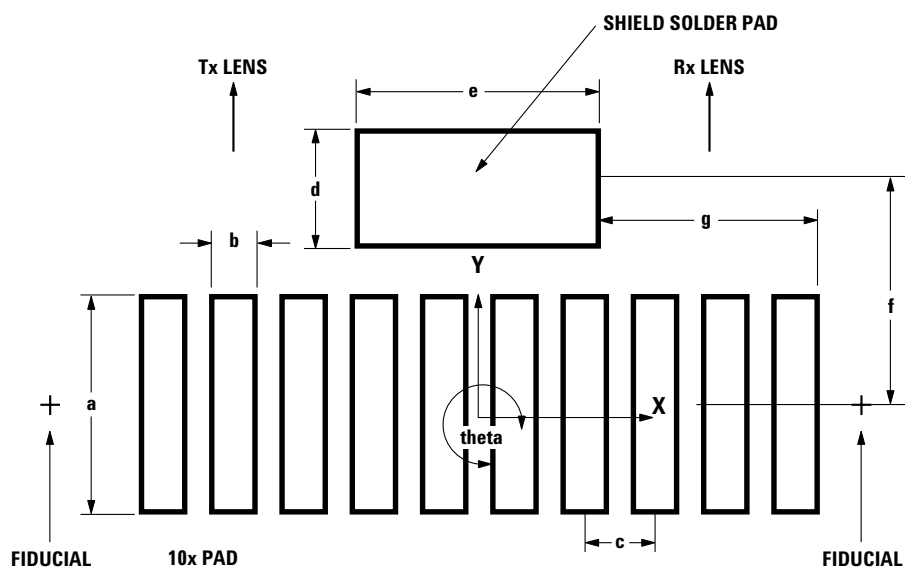


Figure 2.0. Top view of land pattern.

1.2 Adjacent Land Keep-out and Solder Mask Areas

| Dim. | mm | Inches |
|------|----------|------------|
| h | min. 0.2 | min. 0.008 |
| j | 13.4 | 0.528 |
| k | 4.7 | 0.185 |
| l | 3.2 | 0.126 |

- Adjacent land keep-out is the **maximum space** occupied by the unit relative to the land pattern. There should be no other SMD components within this area.
- “**h**” is the minimum solder resist strip width required to avoid solder bridging adjacent pads.
- It is recommended that 2 fiducial cross be placed at mid-length of the pads for unit alignment.

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

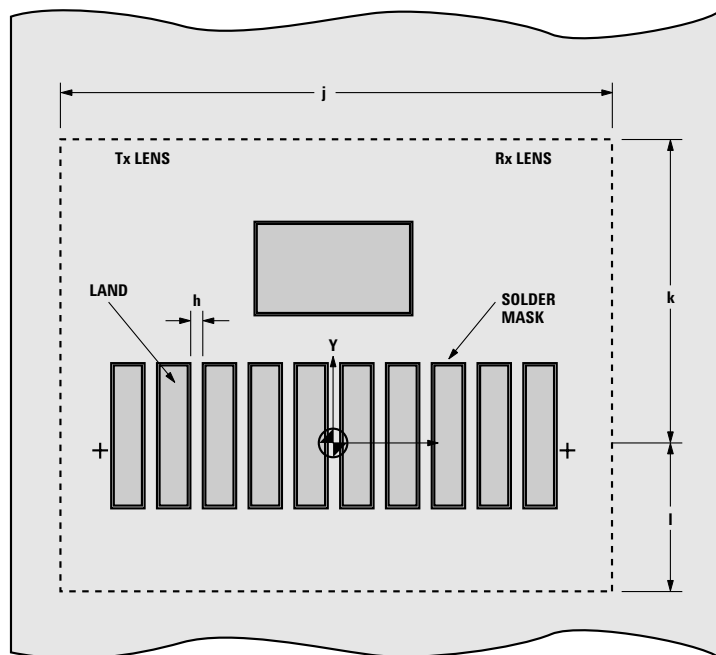


Figure 3.0. HSDL-3612-007/-037 PCBA – Adjacent land keep-out and solder mask.

2.0 Recommended Solder Paste/Cream Volume for Castellated Joints

Based on calculation and experiment, the printed solder paste volume required per castellated pad is 0.30 cubic mm (based on either no-clean or aqueous solder cream types with typically 60 to 65% solid content by volume).

2.1 Recommended Metal Solder Stencil Aperture

It is recommended that only 0.152 mm (0.006 inches) or 0.127 mm (0.005 inches) thick stencil be used for solder paste printing. This is to ensure adequate printed solder paste volume and no shorting. The following combination of metal stencil aperture and metal stencil thickness should be used:

See Fig 4.0

| t, nominal stencil thickness | | l, length of aperture | |
|------------------------------|--------|-----------------------|---------------|
| mm | inches | mm | inches |
| 0.152 | 0.006 | 2.8 ± 0.05 | 0.110 ± 0.002 |
| 0.127 | 0.005 | 3.4 ± 0.05 | 0.134 ± 0.002 |

w, the width of aperture is fixed at 0.70 mm (0.028 inches)

Aperture opening for shield pad is 2.8 mm x 2.35 mm as per land dimensions

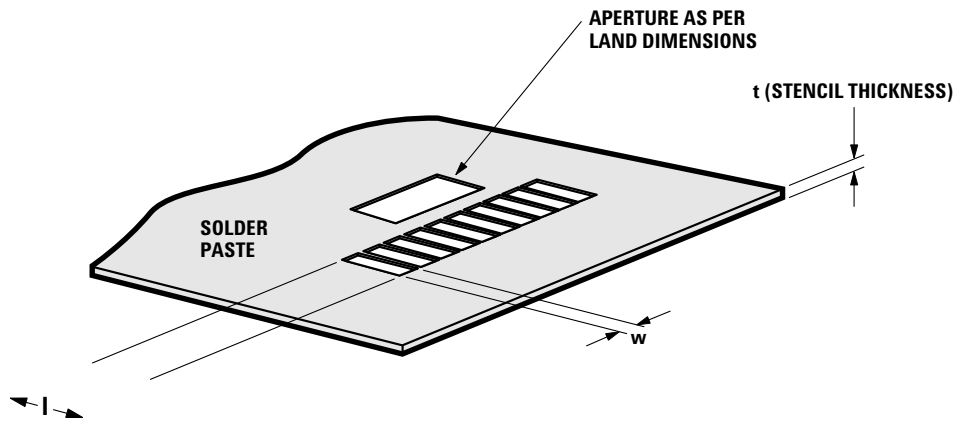


Figure 4.0. Solder paste stencil aperture.

3.0 Pick and Place Misalignment Tolerance and Product Self-Alignment after Solder Reflow

If the printed solder paste volume is adequate, **the unit will self-align** in the X-direction after solder reflow. Units should be properly reflowed in IR Hot Air convection oven using the recommended reflow profile. The direction of board travel does not matter.

Allowable Misalignment Tolerance

| | |
|-------------------|-------------------------|
| X – direction | ≤ 0.2 mm (0.008 inches) |
| Theta – direction | ± 2 degrees |

3.1 Tolerance for X-axis Alignment of Castellation

Misalignment of castellation to the land pad should not exceed 0.2 mm or approximately half the width of the castellation during placement of the unit. The castellations will completely self-align to the pads during solder reflow as seen in the pictures below.



Photo 1.0. Castellation misaligned to land pads in x-axis before reflow.

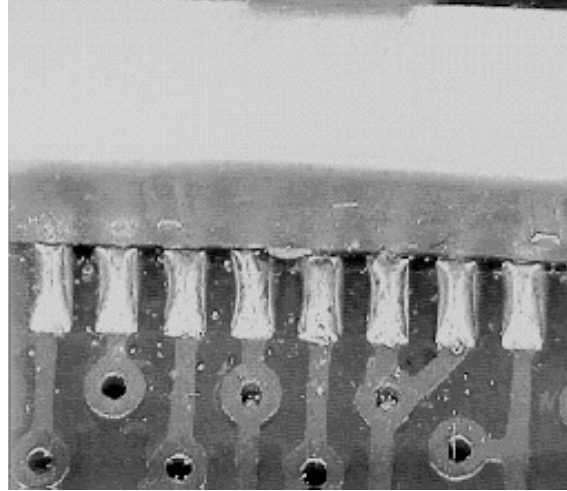


Photo 2.0. Castellation self-align to land pads after reflow.

3.2 Tolerance for Rotational (Theta) Misalignment

Units when mounted should not be rotated more than ± 2 degrees with reference to center X-Y as specified in Fig 2.0. Pictures 3.0 and 4.0 show units before and after reflow. Units with a Theta misalignment of more than 2 degrees do not completely self align after reflow. Units with ± 2 degree rotational or Theta misalignment self-aligned completely after solder reflow.

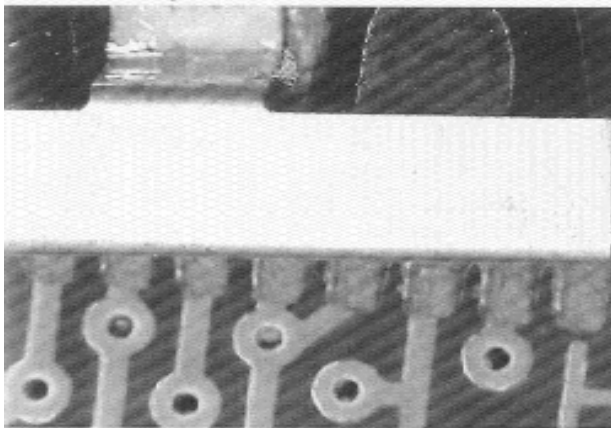


Photo 3.0. Unit is rotated before reflow.

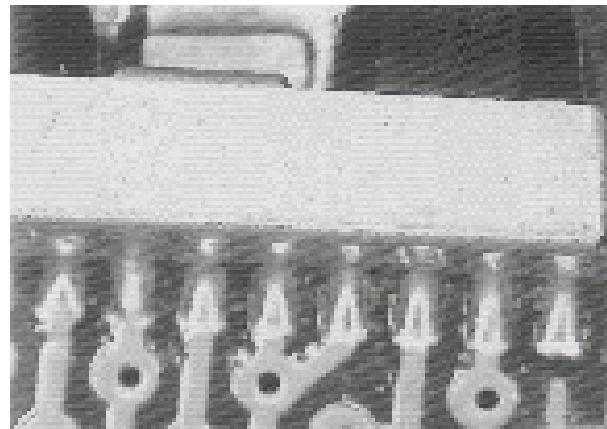


Photo 4.0. Unit self-aligns after reflow.

3.3 Y-axis Misalignment of Castellation

In the Y-direction, the unit does not self-align after solder reflow. It is recommended that the unit be placed in line with the fiducial mark (mid-length of land pad.) This will enable sufficient land length (minimum of 1/2 land length.) to form a good joint. See Fig 5.0.

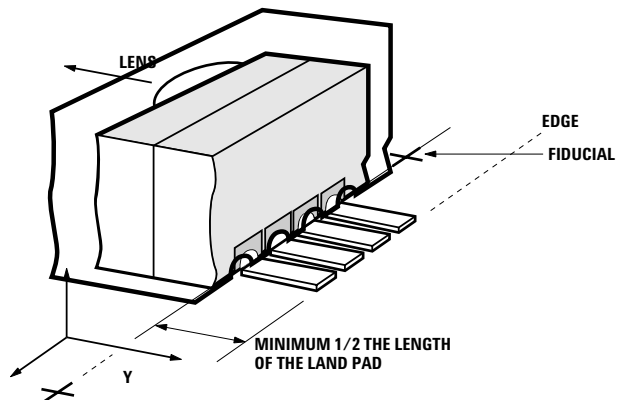


Figure 5.0. Section of a castellation in Y-axis.

3.4 Example of Good HSDL-3612-007/-037 Castellation Solder Joints

This joint is formed when the printed solder paste volume is adequate, i.e. 0.30 cubic mm and reflowed properly. It should be reflowed in IR Hot-air convection reflow oven. Direction of board travel does not matter.

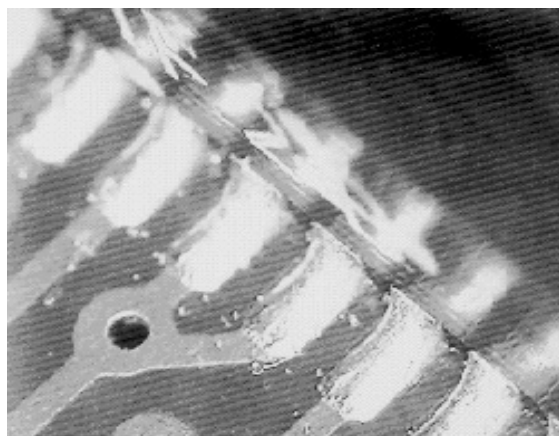
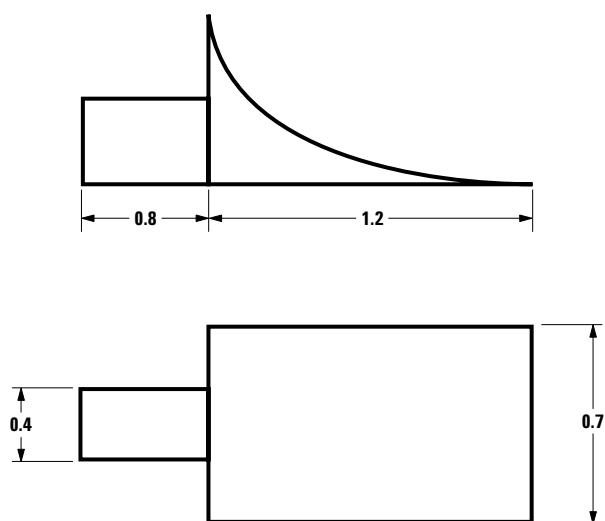


Photo 5.0. Good solder joint.

4.0 Solder Volume Evaluation and Calculation

Geometry of an HSDL-3612-007/ -037 solder fillet.



Appendix B: HSDL-3612-008/-038 SMT Assembly Application Note

1.0. Solder Pad, Mask, and Metal Solder Stencil Aperture

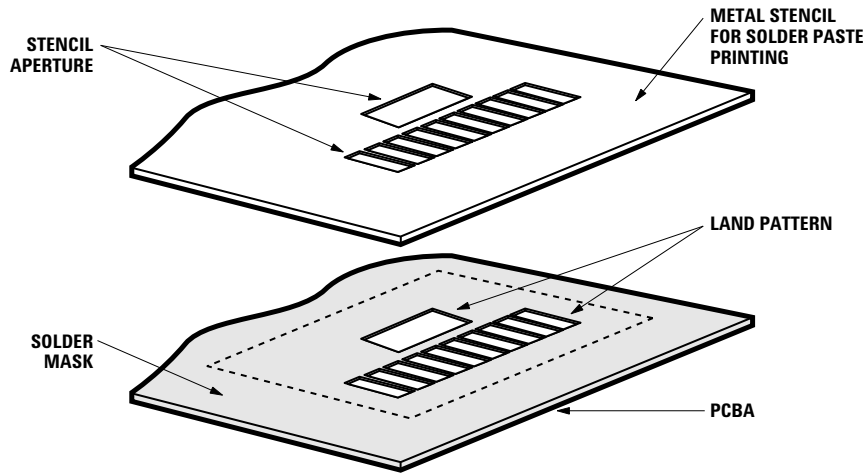
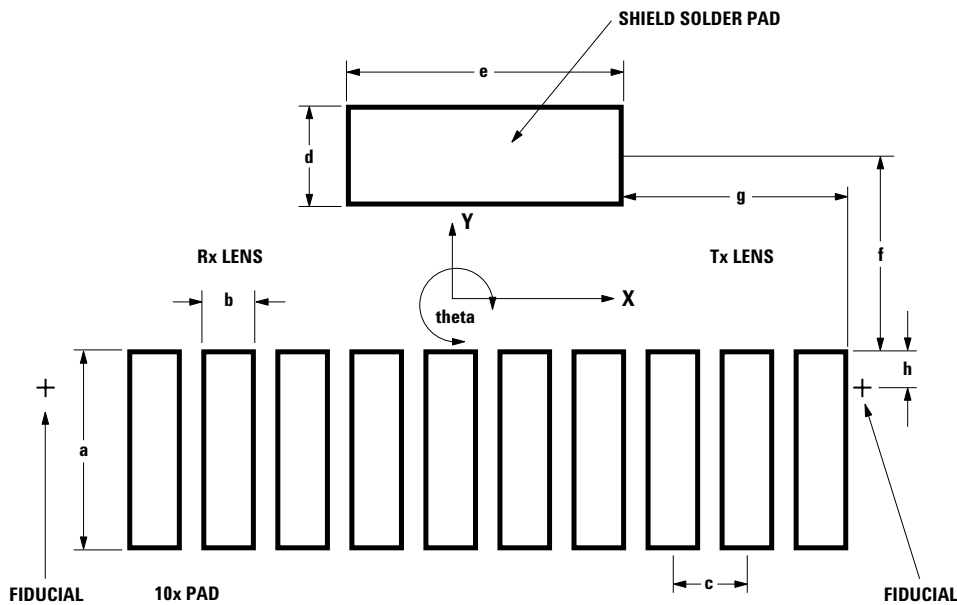


Figure 1. Stencil and PCBA.

1.1. Recommended Land Pattern for HSDL-3612-008/-038

| Dim. | mm | inches |
|-----------|------|--------|
| a | 1.95 | 0.077 |
| b | 0.60 | 0.024 |
| c (pitch) | 1.10 | 0.043 |
| d | 1.60 | 0.063 |
| e | 5.70 | 0.224 |
| f | 3.80 | 0.123 |
| g | 2.40 | 0.170 |



2.0 Y-axis Misalignment of Castellation

In the Y-direction, the unit does not self-align after solder reflow. It is recommended that the unit be placed in line with the fiducial mark (mid-length of land pad). This will enable sufficient land length (minimum of $\frac{1}{2}$ land length) to form a good joint. See Figure 2.

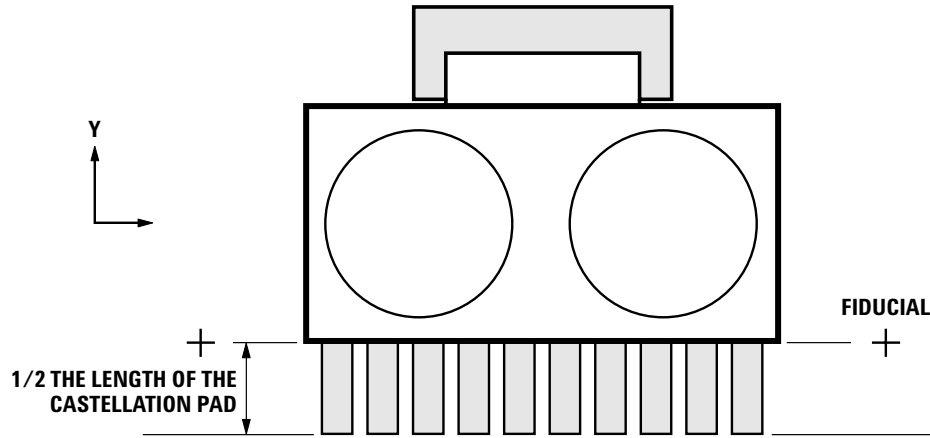


Figure 2. Section of a castellation in Y-axis.

Appendix C: Optical Port Dimensions for HSDL-3612:

To ensure IrDA compliance, some constraints on the height and width of the window exist. The minimum dimensions ensure that the IrDA cone angles are met without vignetting. The maximum dimensions minimize the effects of stray light. The minimum size corresponds to a cone angle of 30° and the maximum size corresponds to a cone angle of 60° .

In the figure below, X is the width of the window, Y is the height of the window and Z is the distance from the HSDL-3612 to the back of the window. The distance from the center of the LED lens to the center of the photodiode lens, K, is 7.08mm. The equations for computing the window dimensions are as follows:

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

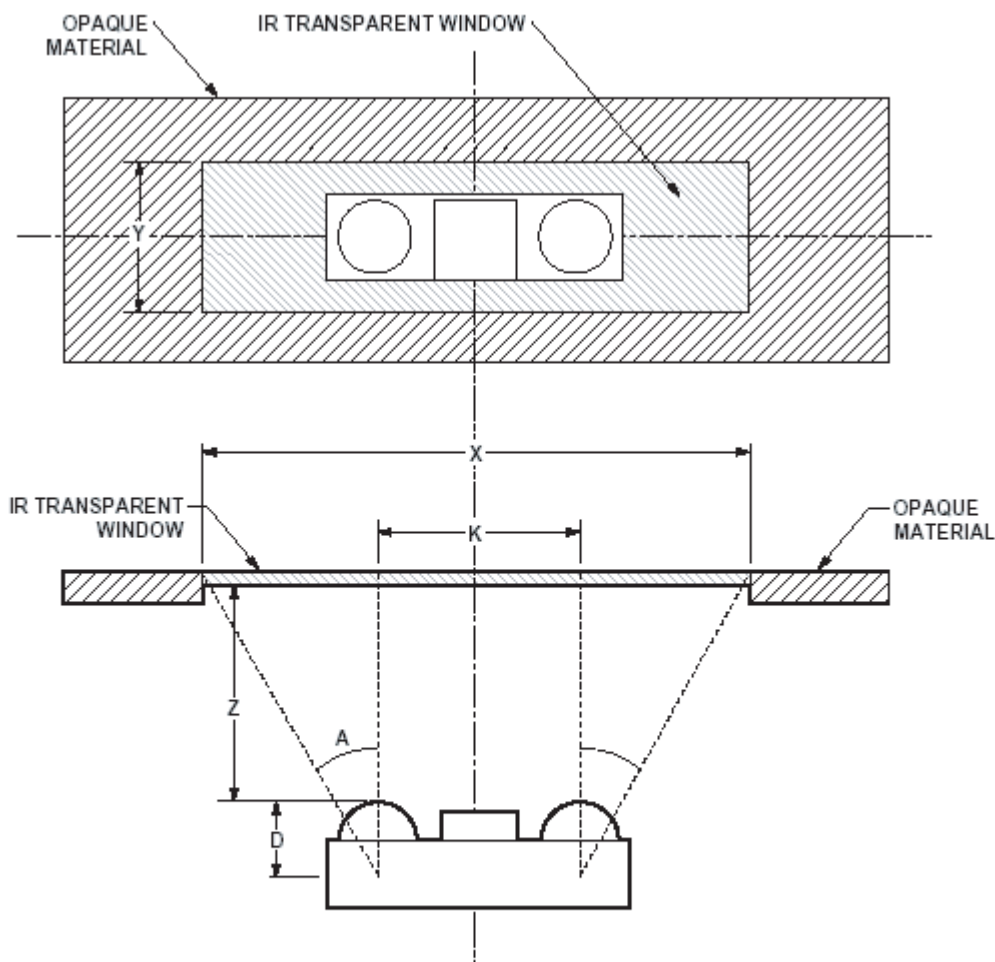
$$Y = 2 \cdot (Z + D) \cdot \tan A$$

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

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

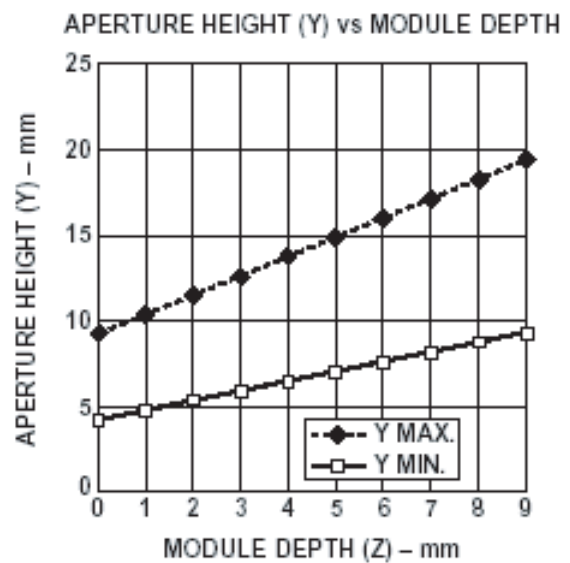
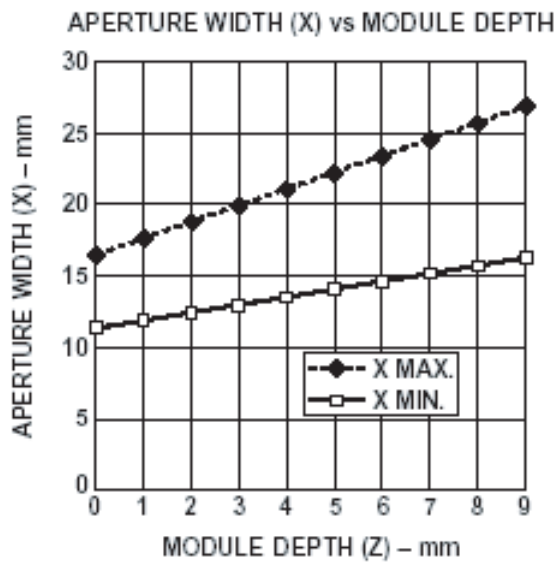
where 't' is the thickness of the window and 'n' is the refractive index of the window material.

The depth of the LED image inside the HSDL-3612, D, is 8mm. 'A' is the required half angle for viewing. For IrDA compliance, the minimum is 15° and the maximum is 30° . Assuming the thickness of the window to be negligible, the equations result in the following tables and graphs:



Section of a castellation in Y-axis.

| Module Depth, (z) mm | Aperture Width (x, mm) | | Aperture height (y, mm) | |
|----------------------|------------------------|--------|-------------------------|-------|
| | max. | min. | max. | min. |
| 0 | 16.318 | 11.367 | 9.238 | 4.287 |
| 1 | 17.472 | 11.903 | 10.392 | 4.823 |
| 2 | 18.627 | 12.439 | 11.547 | 5.359 |
| 3 | 19.782 | 12.975 | 12.702 | 5.895 |
| 4 | 20.936 | 13.511 | 13.856 | 6.431 |
| 5 | 22.091 | 14.047 | 15.011 | 6.967 |
| 6 | 23.246 | 14.583 | 16.166 | 7.503 |
| 7 | 24.401 | 15.118 | 17.321 | 8.038 |
| 8 | 25.555 | 15.654 | 18.475 | 8.574 |
| 9 | 26.710 | 16.190 | 19.630 | 9.110 |



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 percent or less for best optical performance. Light loss should be measured at 875 nm.

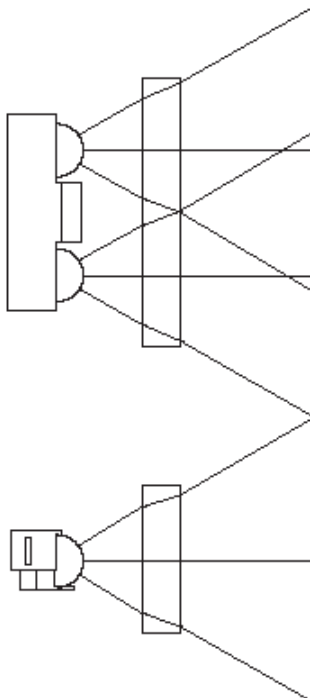
Shape of the Window

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.

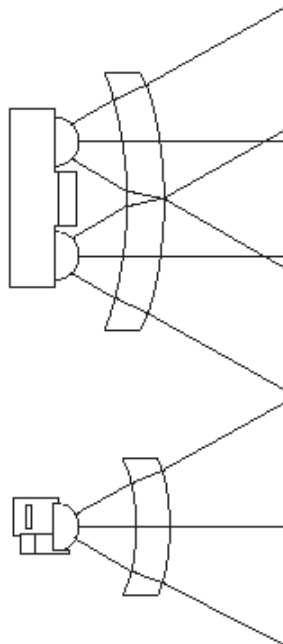
If the window must be curved for mechanical or industrial design reasons, place the same curve on the back side of the window that has an identical radius as the front side. While this will not completely eliminate the lens effect of the front curved surface, it will significantly reduce the effects. 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.

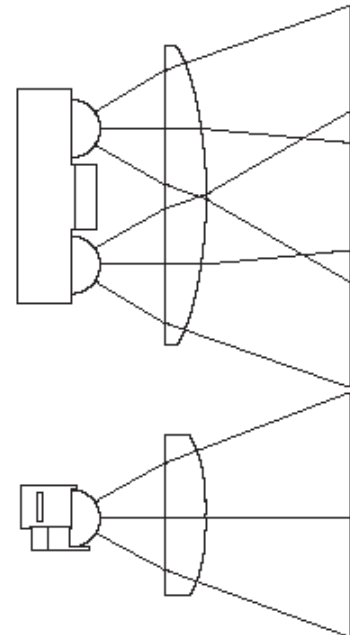
Flat Window
(First choice)



Curved Front and Back
(Second choice)



Curved Front, Flat Back
(Do not use)



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