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Application note

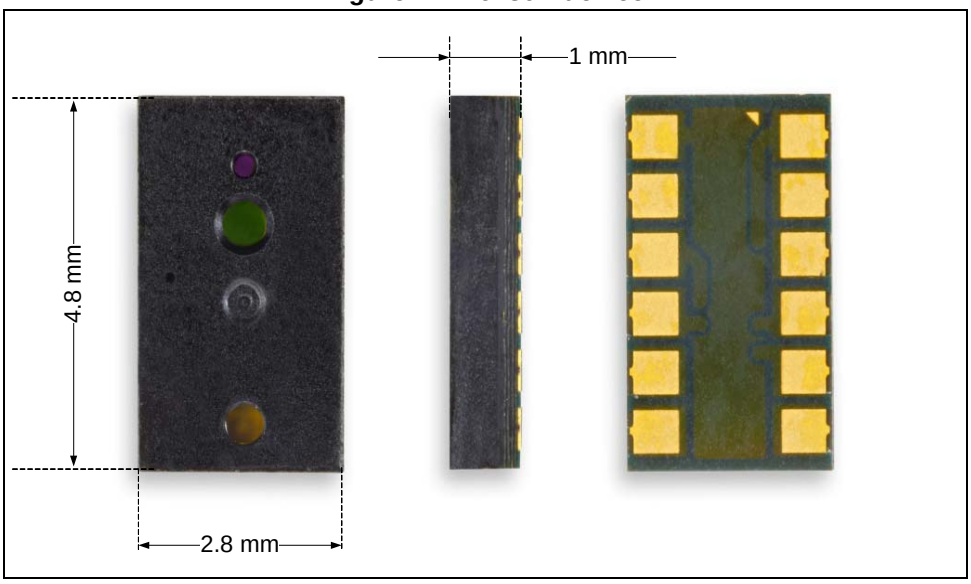
VL6180X proximity and ambient light sensor, cover glass selection

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Introduction

The aim of this document is to give all information to a user to select the cover glass above the VL6180X.

Figure 1. VL6180X device



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1 Overview

Typically the VL6180X proximity sensor will be used in conjunction with some sort of glass covering. The cover glass serves two main purposes:

1. Provides physical protection of the device, including dust ingress prevention.
2. Provides optical filtering for both the ALS and proximity functions.

The cover glass will normally be opaque with either two circular apertures or one oval aperture to allow the emission and receiving of light. It is assumed that the filter is deposited on the underside of the glass.

This application note will detail how to calculate the minimum aperture size for a specific air gap between the VL6180X and cover glass. It will also detail some of the known issues when selecting the correct optical filter.

2 Optical filtering

The cover glass has to allow through the IR light at 850nm emitted and received by the proximity sensor. If the ALS functionality of the VL6180X is to be used, the cover glass also has to allow through enough visible light to allow the lux level to be calculated.

2.1 Optical transmission

450 and 650 nm: 5 to 15% transmission (only required if ALS functionality is required)

Above 800nm: >80% transmission

2.2 Potential issues

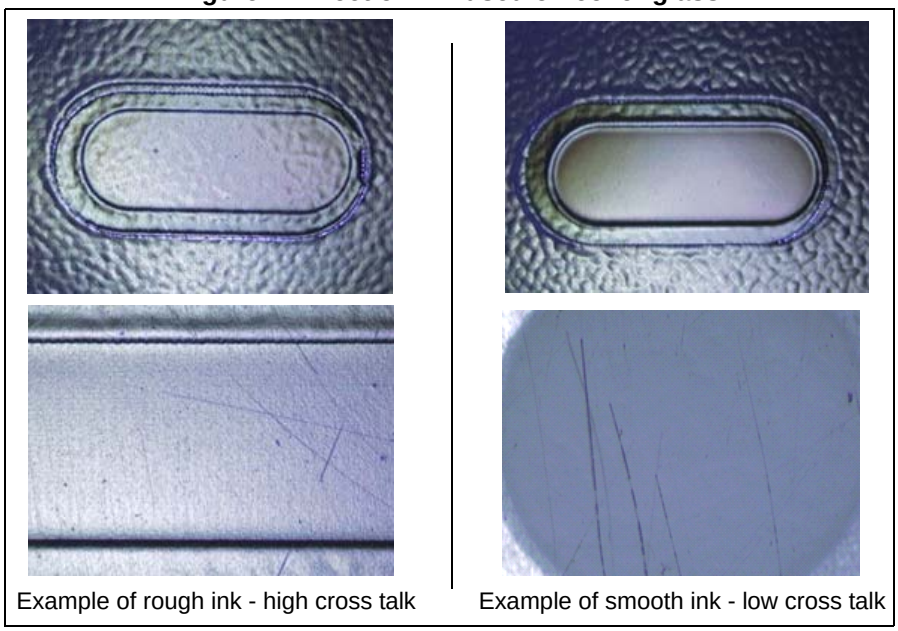
2.2.1 Cross talk

When using the VL6180X in ranging mode, the cross talk is defined as the signal from the emitter reflecting off the cover glass and being sensed by the receiver. The VL6180X can tolerate and compensate for a certain amount of cross talk, but this need to be minimised as much as possible. The type of IR ink coating used on the cover glass can have a significant effect on the amount of cross talk.

The glass surface should be as smooth as possible, with ideally a roughness value (Ra) of < 0.04.

$$R_a = \frac{1}{n}\sum_{i=1}^{n}|y_i|$$ y_i = abs. deviation from best fit plane

Figure 2. Effect on ink used on cover glass

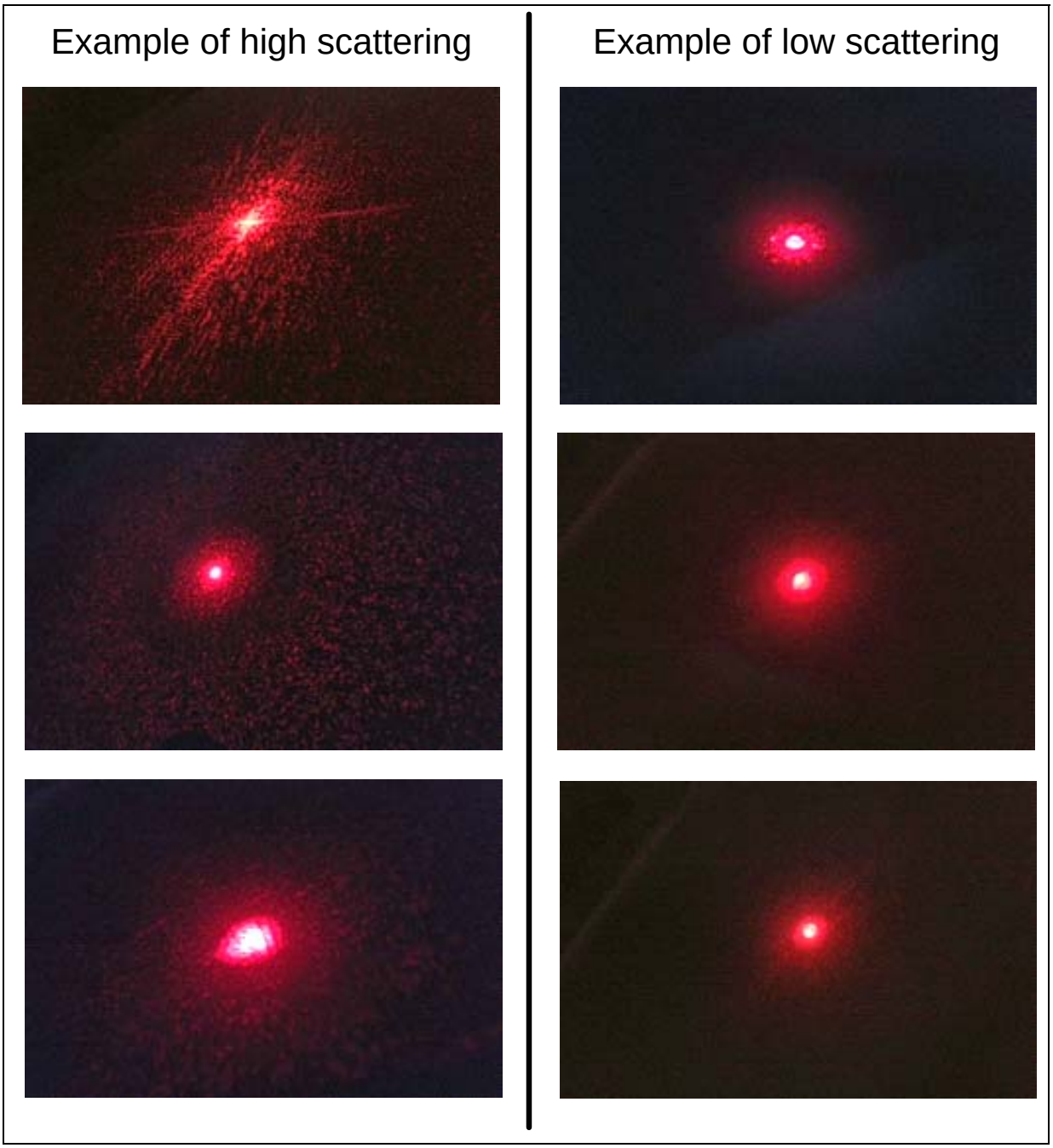


Example of rough ink - high cross talk

Example of smooth ink - low cross talk

Each time the light passes through the glass, it will be scattered to a certain extent. The amount of scattering will be determined by several factors including the roughness and the IR cut off position. The wavelength of the cut off between visible and IR should be designed to be nearer 650nm than 840nm.

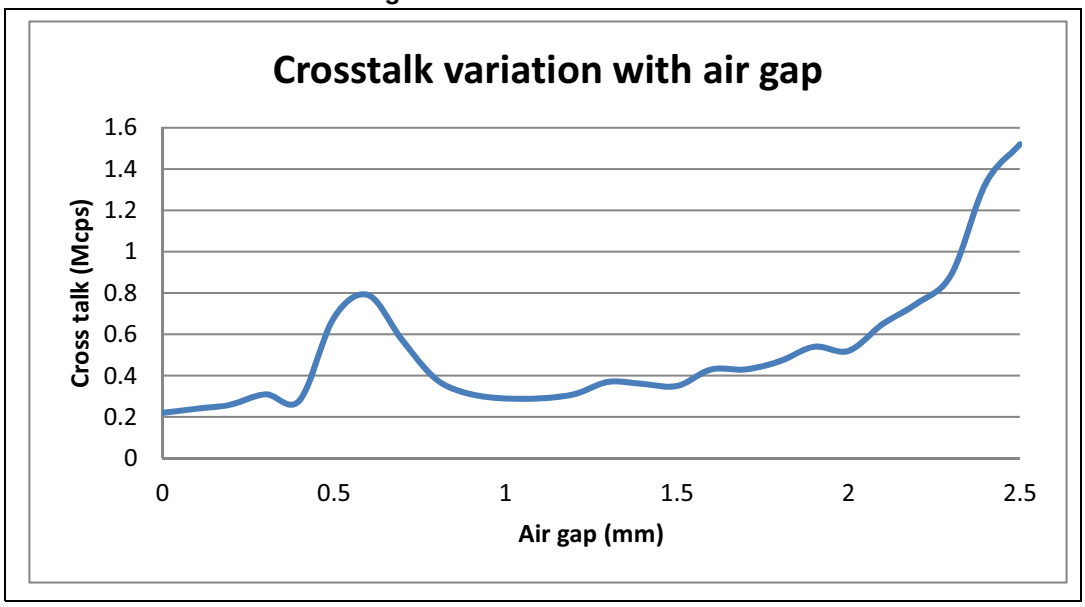
Figure 3. Examples of scattering



2.2.2 Air gap

The distance between the VL6180X and the cover glass is referred to as the air gap. As the air gap increases, the amount of cross talk also increases. The cross talk compensation defines the gain applied in the system to compensate for the cross talk.

Figure 4. Cross talk variation



For optimum ranging performance, the crosstalk should be kept low. *Figure 4* shows the typical cross talk seen when used with a cover glass with oval aperture.

The variation in the amount of cross talk compensation required can be important if the air gap is likely to change throughout the lifetime of the system.

3 Glass hole size

If IR transparent holes in the cover glass are used, determining the size of the holes is based on simple geometry. *Figure 5* below gives the glass hole values versus the Air gap value. For aesthetic purposes, it may be desirable to have two equal sized holes, but the IR emitter hole can be made smaller.

The VL6180X contains both a proximity sensor and an ALS sensor. If only proximity sensing is required, there is no need to allow light into the ALS hole. Indeed a small increase in ranging performance may be observed if the ALS hole is covered.

Suggested dimensions are provided for both oval and circular holes, with and without the ALS functionality.

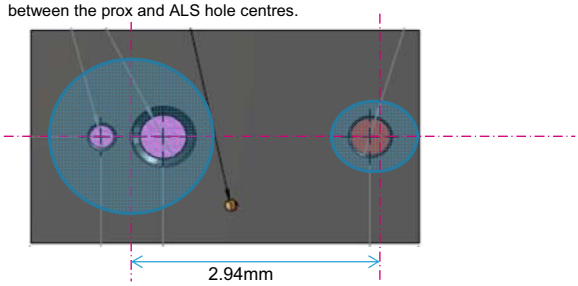
Figure 5. Glass hole size values

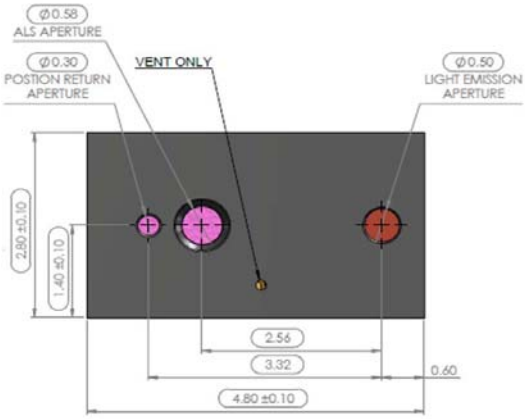
Tolerance (+/-um) 200 (set by customer)

Distance between ALS & prox: 0,76
ALS outer diameter at top surface 0,78

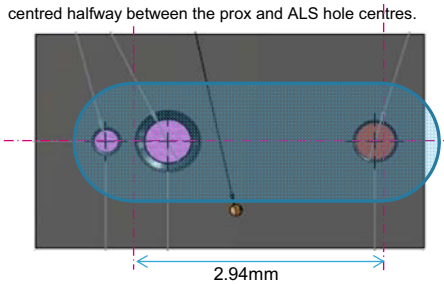
Air Gap	VCSEL Diameter (mm)	ALS Only Diameter (mm)	Prox Only Diameter (mm)	ALS & Prox Diameter (mm)	Oval (VCSEL, Prox & ALS) Diameter (mm)
0	0,71	1,14	0,71	1,90	1,47
0,1	0,76	1,34	0,76	2,10	1,52
0,2	0,80	1,54	0,80	2,30	1,56
0,3	0,85	1,74	0,85	2,50	1,74
0,4	0,89	1,94	0,89	2,70	1,94
0,5	0,94	2,14	0,94	2,90	2,14
0,6	0,98	2,34	0,98	3,10	2,34
0,7	1,03	2,54	1,03	3,30	2,54
0,8	1,07	2,74	1,07	3,50	2,74
0,9	1,11	2,94	1,11	3,70	2,94
1	1,16	3,14	1,16	3,90	3,14
1,1	1,20	3,34	1,20	4,10	3,34
1,2	1,25	3,54	1,25	4,30	3,54
1,3	1,29	3,74	1,29	4,50	3,74
1,4	1,34	3,94	1,34	4,70	3,94
1,5	1,38	4,14	1,38	4,90	4,14
1,6	1,42	4,34	1,42	5,10	4,34
1,7	1,47	4,54	1,47	5,30	4,54
1,8	1,51	4,74	1,51	5,50	4,74
1,9	1,56	4,94	1,56	5,70	4,94
2	1,60	5,14	1,60	5,90	5,14

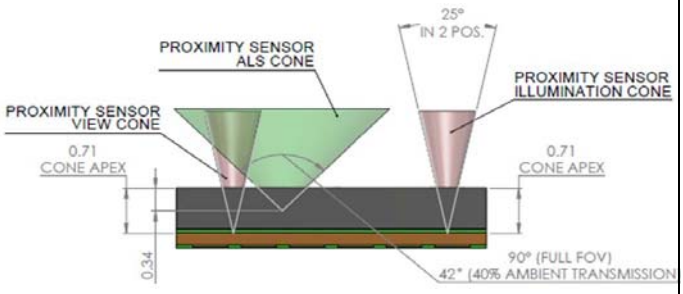
The ALS & Prox together assumes one aperture covering both the prox and ALS holes, centred halfway between the prox and ALS hole centres.





Alternatively an oval artwork could be used.
Centred on the VCSEL and
centred halfway between the prox and ALS hole centres.





Notes

1 This spreadsheet is intended to help the user determine the optimum size of 'holes' to be used in the cover glass of the VL6180X.

2 The 'holes' refer to the areas that trasmsits IR 850 nm light, above the VCSEL and return array. The other areas should be opaque to IR light.

3 This method can also be used to work out the size of holes in a gasket.

4 Revision history

Table 1. Document revision history

Date	Revision	Changes
3-Jun-2014	1	Initial release.

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