APDS-9120-020

Integrated Optical Proximity Sensor Window Design Guide

Application Note 5464

When using the Avago APDS-9120 integrated optical proximity sensor, a transparent window with a high IR transmittance of at least 85% is recommended. However, if the window needs to have a dark color or shade for cosmetic or other reasons, the window material can be colored. Alternatively, it is also possible to coat a layer of colored IR-pass material below the transparent window material, as shown in Figure 1. For both cases, it is recommended that the colored window material and the IR-pass coating material should have at least 85% IR transmittance.

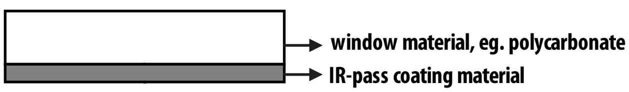


Figure 1. Window with IR Transmittance

Both glass and plastic are suitable materials for the window. For plastic, the materials can be polycarbonate or PET. The surface finish of the plastic should be smooth, without any texture. The recommended plastic material for use as a window is available from Bayer AG and Bayer Antwerp N. V. (Europe), Bayer Corp. (USA) and Bayer Polymers Co., Ltd. (Thailand), as shown in Table 1.

Table 1. Recommended plastic window materials

Bayer Part Number	Visible light transmission*	Refractive index
Makrolon LQ2647	87%	1.587
Makrolon LQ3147	87%	1.587
Makrolon LQ3187	85%	1.587

To ensure that APDS-9120 performance is not affected by improper window design, there are some constraints on window thickness (t) and the air gap (h) between the sensor and the window. These constraints ensure that when a maximum thickness window is placed in front of the APDS-9120 its sensing properties will not be degraded.

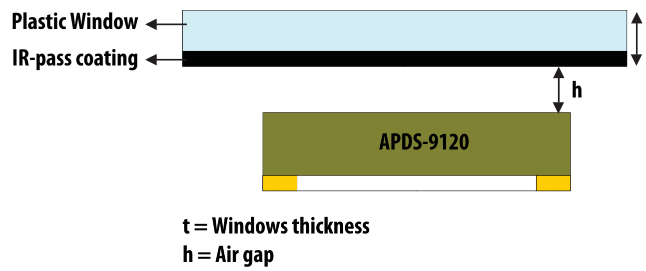


Figure 2. Side view of APDS-9120

For optimum performance, it is recommended that there should be no air gap (h = 0 mm). However, in most circumstances it will be difficult to maintain a 0 mm air gap between the sensor and the window. Therefore, to solve this problem, a hollow air pipe type structure can be included in the design, as shown in Figure 3.

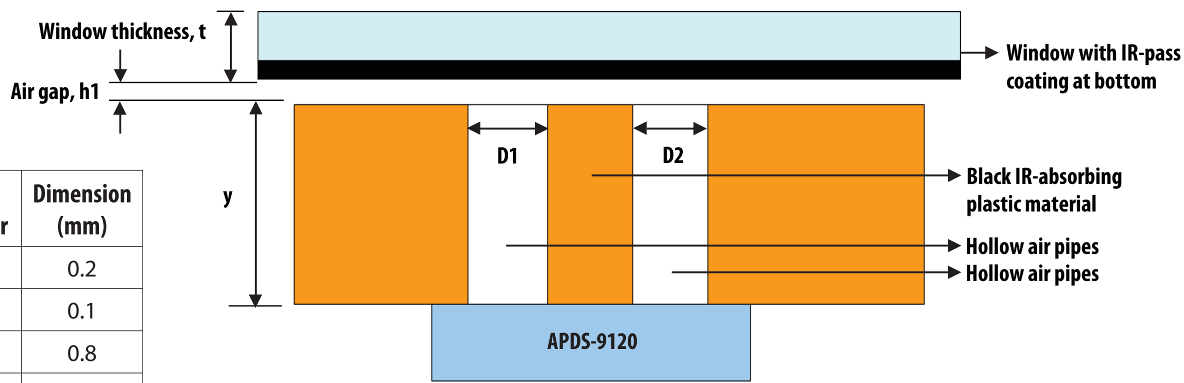
Ideally, the internal walls of the hollow air pipe would be made of high IR reflecting material. In addition, it is important that the section separating the two hollow air pipes must be IR-absorbing material.

However, for simplicity of the design, the entire hollow air pipe structure, including the internal walls, can typically be a black, opaque and IR-absorbing plastic casing material. Since it will absorb IR rays it is recommended that the height of air pipe structure, y, should be kept small.

The air gap, h1, between the black plastic hollow air pipe structure and the window must also be kept small, not more than 0.2 mm. It is also recommended that the window thickness, t, be kept small.

The recommended design values for the hollow air pipe structure are shown in Figure 3.

The simulated results based on the values shown in Table 2 are shown in Figure 4. The only parameter varied was the window thickness, t. Window thicknesses of 0.2, 0.5 and 1 mm were used in the simulation. “Distance” refers to the distance from the window’s top surface to the detected object. In the simulation, the detected object was a surface with 18% reflectance.



Parameter	Dimension (mm)
t	0.2
h1	0.1
y	0.8
D1	1.2
D2	1.2

Figure 3. Proposed solution using a hollow air pipe structure when the air gap between the sensor to the window is >0mm.

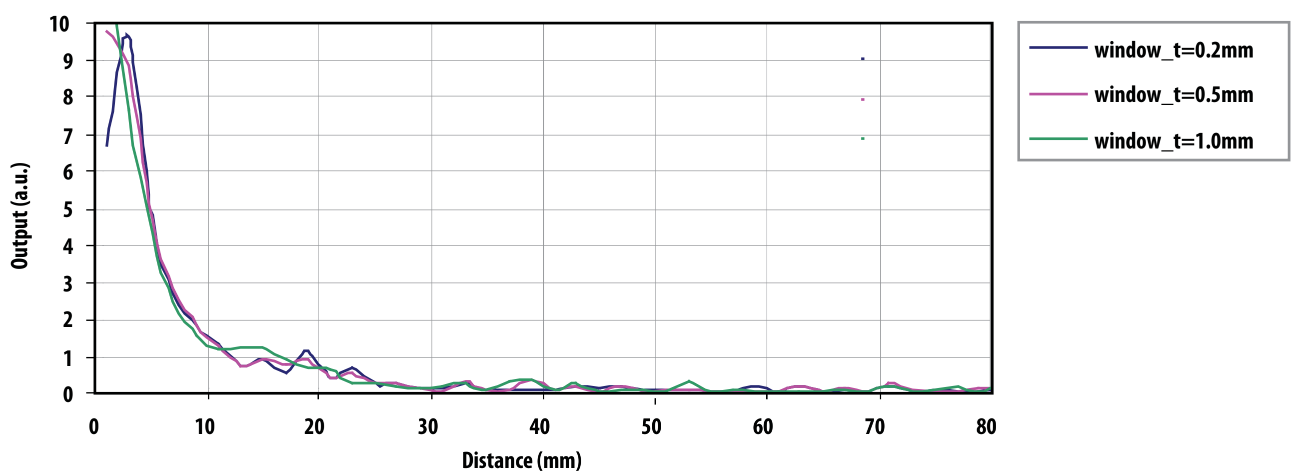


Figure 4. Simulated results using 3 different window thickness

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