PAA3905E1-Q: Lens Holder Design Application Note (AN03)

General Description

This Application Note provides information and guidance in designing a lens holder that holds the lens mechanically without needing glue after the lens is inserted into the PAA3905E1-Q chip package. The user is responsible for selecting, designing, and qualifying the lens holder for their specific usage.

Ordering Information

Part Number	Description
PAA3905E1-Q	Optical Motion Tracking Chip
L242-ZSZ1	Lens Set

RoHS compliant

For any additional inquiries, please contact us at https://www.pixart.com

Table of Contents

List of Figures

List of Tables

1.0 Introduction

1.1 Overview

The PAA3905E1-Q is PixArt Imaging's optical motion tracking chip specifically designed for low-light condition operation. The matching lens set provides a 42-degree effective viewing angle (FOV) and allows motion tracking under low light conditions as low as 5 lux. This document describes the information and guidance in designing a lens holder that holds the lens mechanically for PAA3905E1-Q.

1.2 Relevant Information

Table 1. Related Document

No.	Item	Version
1	PAA3905E1-Q Datasheet	1.0
2	L242-ZSZ1: Lens Datasheet	1.0

1.3 Terminology

Term	Description
FOV	Field of View

2.0 Mechanical Specification

Table 2. Recommended Mechanical Dimension of Lens Holder

Parameter	Symbol	Min.	Typ.	Max.	Unit	Note
Opening diameter	ø	2.2		2.4	mm	Refer to Figure 1 and Figure 2
Opening conical angle	°	70			degree	Refer to Figure 1
Lens holder height	Z		4.15		mm	Total height of the lens holder, refer to Figure 3 and Figure 5
X misalignment	X_m	- 0.15		0.15	mm	Lateral misalignment between the lens holder conical center and the optical center.
Y misalignment	Y_m	- 0.15		0.15	mm	Lateral misalignment between the lens holder conical center and the optical center.
Z misalignment	Z_m	- 0.10		0.10	mm	Height Misalignment (Z-position variation) between lens holder and chip package.

3.0 Recommended Lens Holder Design

For optimum performance of PAA3905E1-Q when used with the lens holder, below are the guidelines for the design of the lens holder.

3.1 Lens Holder Design Guideline

- Lens holder should have an opening that does not block the field of view (FOV) of the sensor/lens.
- There must not be any obstruction in the keep clear zone as highlighted in blue in Figure 1.
- The recommended conical opening is between ø2.20mm to ø2.40mm with a conical angle of a minimum of 70°.
- A poron gasket (original thickness 0.40mm) is compressed to 0.20mm thickness after assembly is recommended to be placed in between the lens holder and PAA3905E1-Q package to absorb the stack-up tolerance of the assembly.
- The conical center of the lens holder should be concentric with the optical center.

  Note: the offset between optical center and unit center (refer to Figure 2)
- The example of material for the lens holder is LCP Vectra E130i or any other equivalent material with a surface finishing to follow SPI D-2 standard.

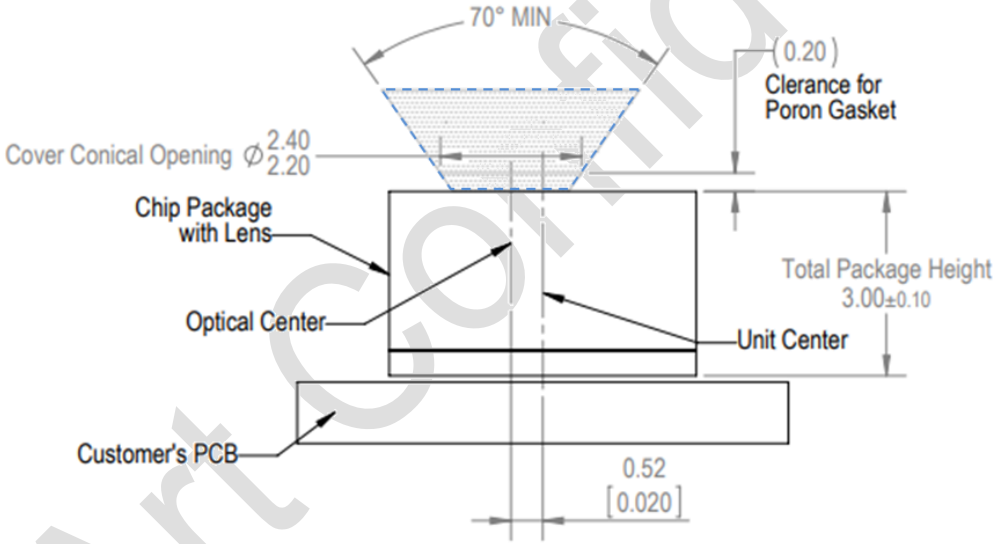


Figure 1. Chip Package's Side View

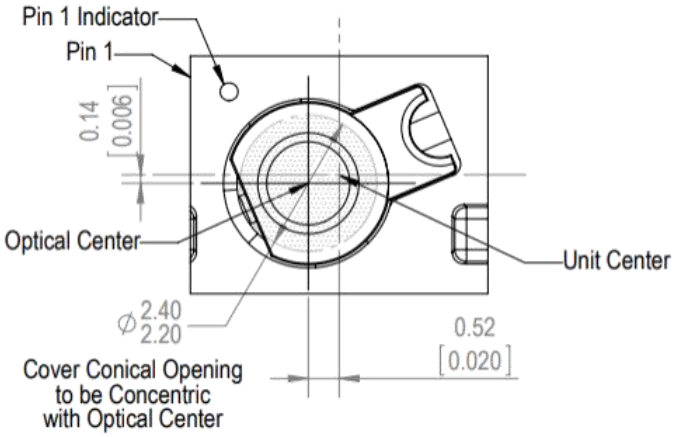


Figure 2. Chip Package's Top View

3.2 Example of Lens Holder Design

This section shows example of lens holder design. Refer to Figure 3 for the assembly view and Figure 5 for mechanical design detail.

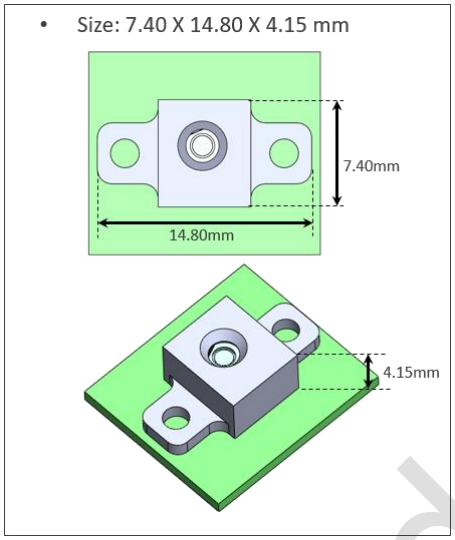


Figure 3. Example of Lens Holder

3.3 Lens holder to Chip Package Assembly Process

1. Insert or attach the lens set to the chip package as described in Section 4.3 of the L242-ZSZ1 Lens Set Datasheet.
2. Place the Lens Holder with a poron gasket over the assembly.
3. The Lens Holder may be secured to the overall customer product assembly via different methods (as in Figure 4) such as:
   i. With mechanical screws.
   ii. With mechanical feature on the customer's top casing pressing on it.
   iii. With posts from the bottom casing of the product that is heat-staked to secure the assembly.

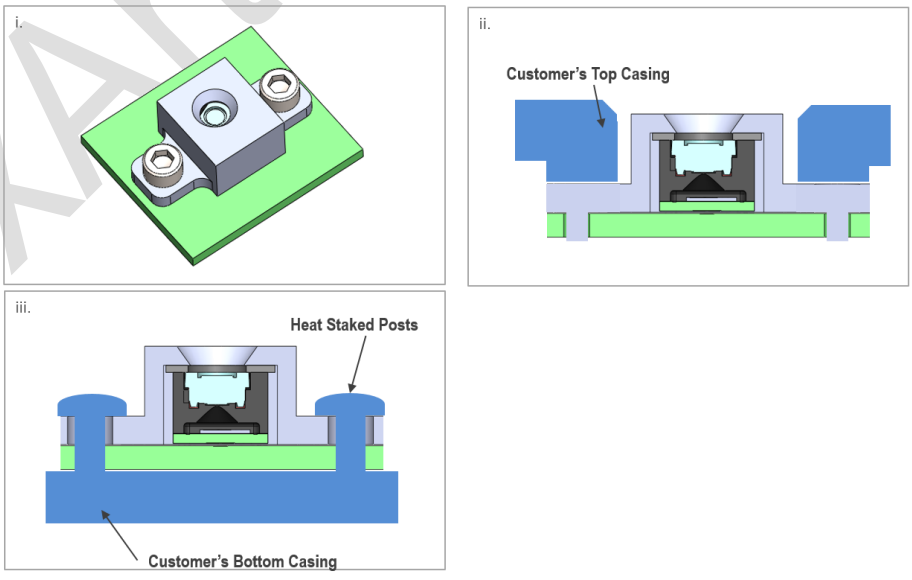
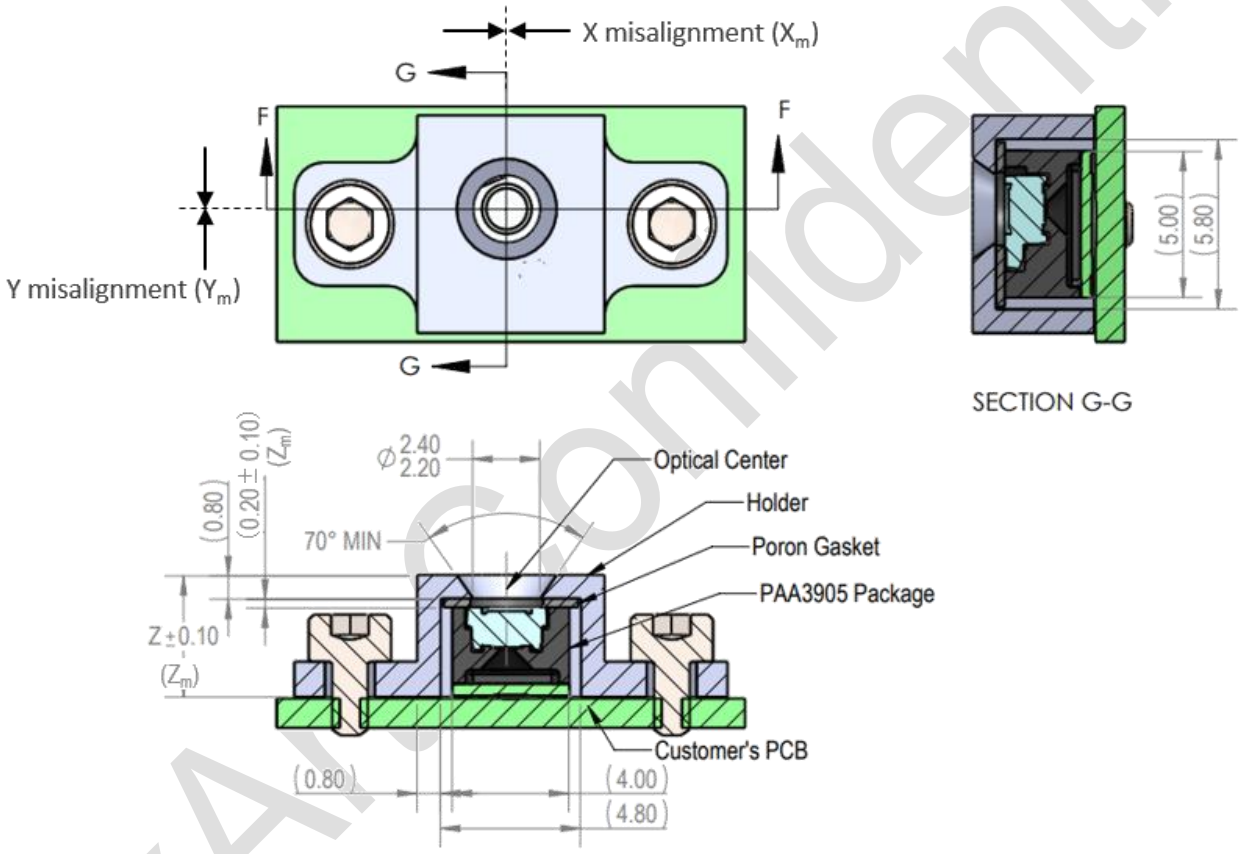


Figure 4. Methods to Secure the Lens Holder

3.4 Recommended Lens Holder Design

- Recommended Lens Holder design and the cross-sectional view are shown in Figure 5.
- A lens holder with a conical opening is designed to hold the lens assembly in place without any epoxy or adhesive. The conical center should be concentric with the optical center. The misalignment between the lens holder's conical center and the optical center, should be maintained within ±0.15mm.
- A poron gasket is recommended to be placed in between the lens holder and the PAA3905 package.
- A poron gasket (original thickness: 0.40mm) is compressed to 0.20mm thickness after assembly is recommended to be placed in between the lens holder and PAA3905 package to absorb the stack-up tolerance of the assembly.
- Total height stack-up tolerance with the lens holder is allowed within ±0.10mm.



Notes:
1. Dimensions in millimeters.
2. Bracket () indicates reference dimension.
3. X and Y misalignment between the cover conical center and the optical center is ±0.15mm max.
4. Z is the total height of the lens holder.
5. Z_m is the stack up tolerance for Z which is ±0.10mm max.

Figure 5. Cross-sectional View

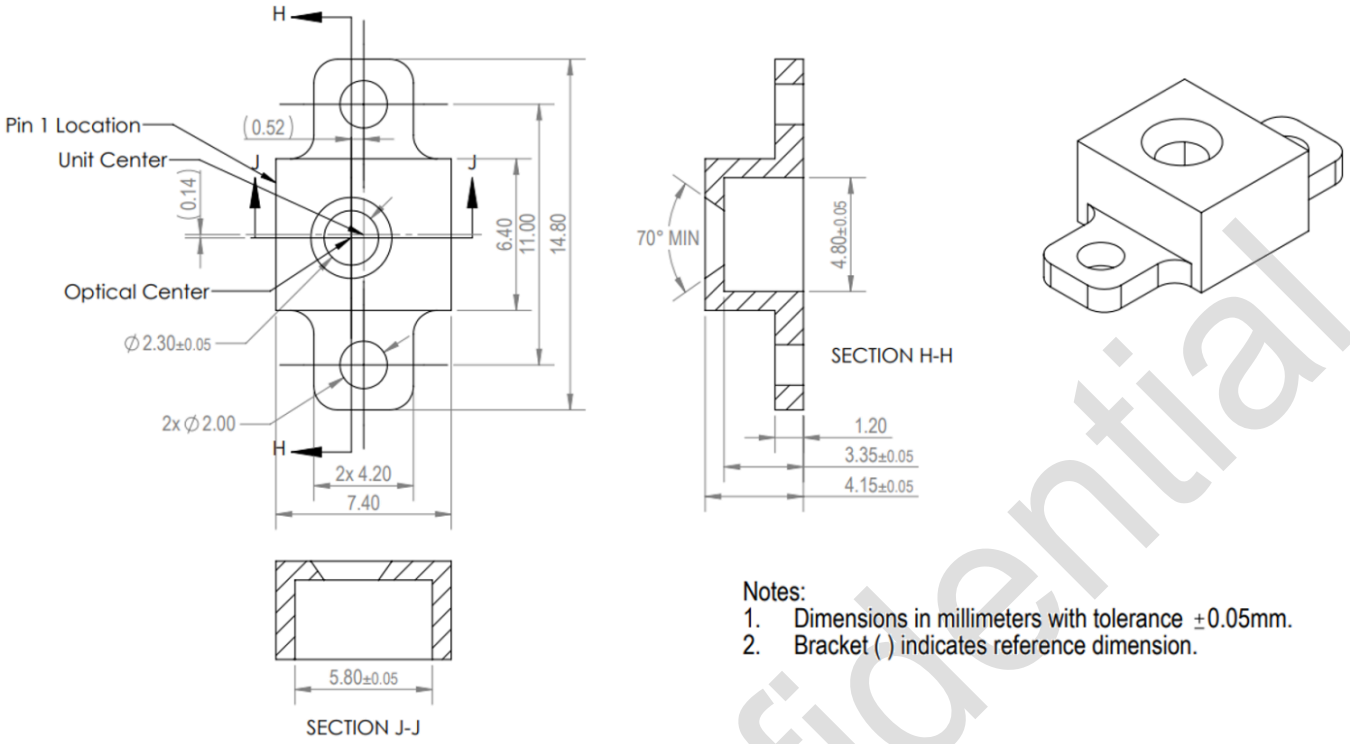


Figure 6. Lens Holder's Reference Design

3.5 Recommended Poron Gasket Design

Figure 7 is recommended the poron gasket to be fitted into the lens holder before the attachment of lens holder & PAA3905. The nominal thickness of the poron gasket is 0.4mm and should be compressed to 0.20mm thickness as shown in Figure 5.

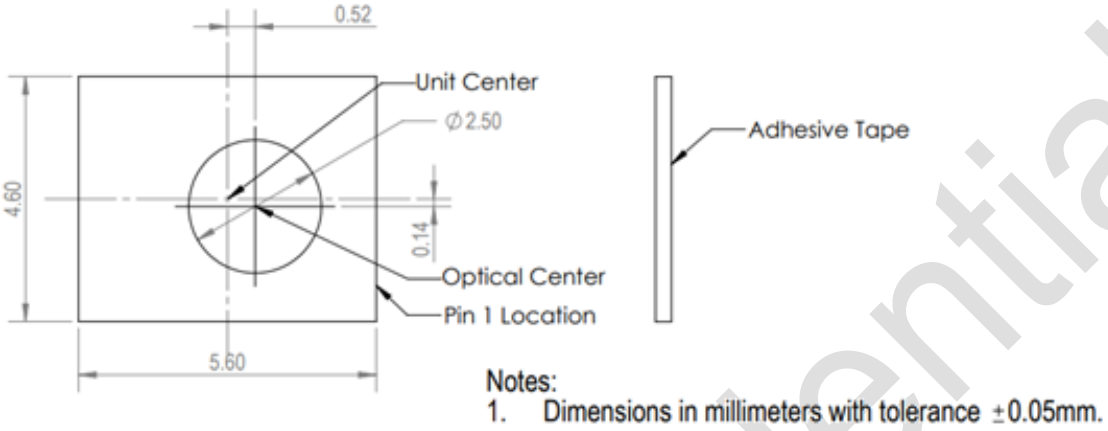


Figure 7. Poron Gasket's Reference Design

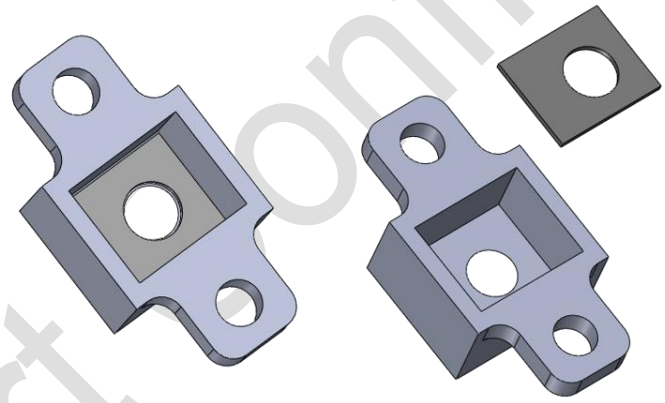


Figure 8. Exploded View of the Poron Gasket with the Lens Holder

Attachment

No.	File Name	Description	Version
1	PAA3905_MechanicalHolder_and _PoronGasket_V1.0.STEP	Poron Gasket with Lens Holder 3D Drawing File in STP format	1.0

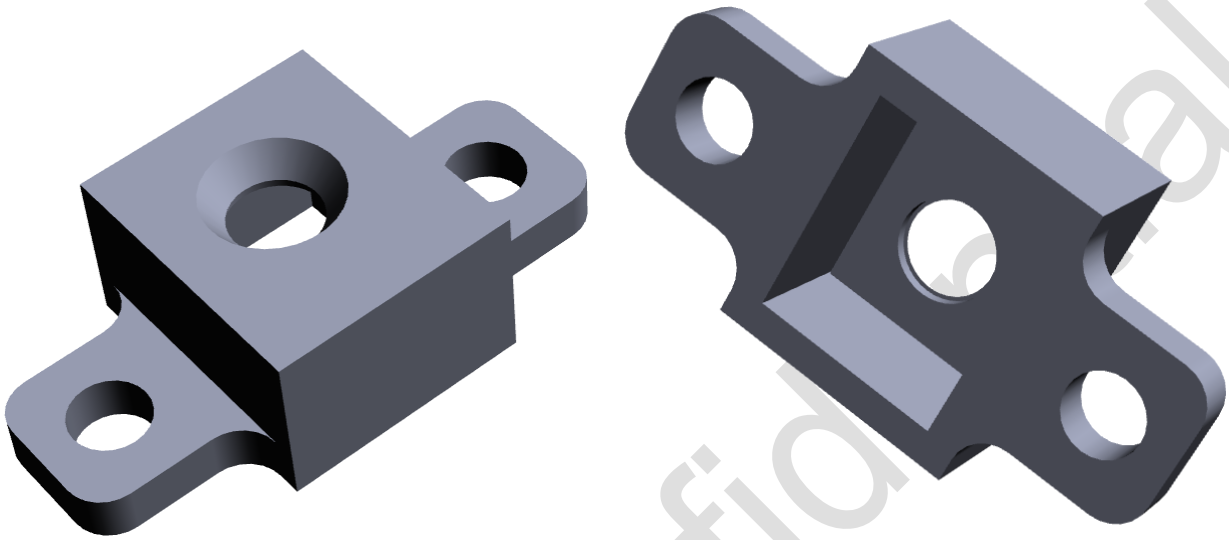


Figure 9. Attachment 1 thumbnail

Revision History

Revision Number	Date	Description
1.0	13 Feb 2023	Initial release