PAT9136E1-TXQT and PAA5160E1-Q: Module Test Recommendation (AN05)

General Description

This application note provides module test and calibration recommendations for PAT9136E1 and PAA5160E1. The recommendations are mainly to ensure optimum performance to meet the chip's specifications.

Ordering Information

Part Number	Description
PAT9136E1-TXQT	Optical Tracking Chip
PAA5160E1-Q	Optical Tracking Chip

RoHS compliant

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

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1.0 Introduction

1.1 Overview

The PAT9136E1-TXQT and PAA5160E1-Q are PixArt Imaging's optical tracking chips with integrated VCSEL illumination. The module referred throughout this application note includes the chip, either PAT9136E1-TXQT or PAA5160E1-Q, mounted with the recommended protective cover as stated in the respective datasheet.

Note: Throughout this application note, the PAT9136E1 and PAA5160E1 are referred to as the "chip".

1.2 Relevant Information

Table 1. Related Document

No.	Item	Version
1	PAA5160E1-Q Product Datasheet	0.83
2	PAA5160E1-Q Sensor Resolution Normalization Application Note (AN00)	1.0
3	PAA5160E1-Q Chip Orientation Determining and Re-mapping Application Note (AN03)	1.0
4	PAT9136E1-TXQT Product Datasheet	0.83
5	PAT9136E1-TXQT and PAA5160E1-Q: Chip Cover Glass and Protective Cover Cleaning Procedure (AN04)	1.0

1.3 Terminology

Term	Description
CPI	Count per Inch
VCSEL	Vertical Cavity Surface Emitting LASER
PCB	Printed Circuit Board
PCBA	Printed Circuit Board Assembly

2.0 Module Test

The purpose of the module test is to ensure the performance of the module (which includes the assembly of the protective cover) on the PCBA. The recommended test items are:

1. Signal Connectivity
2. LASER power
3. Contamination

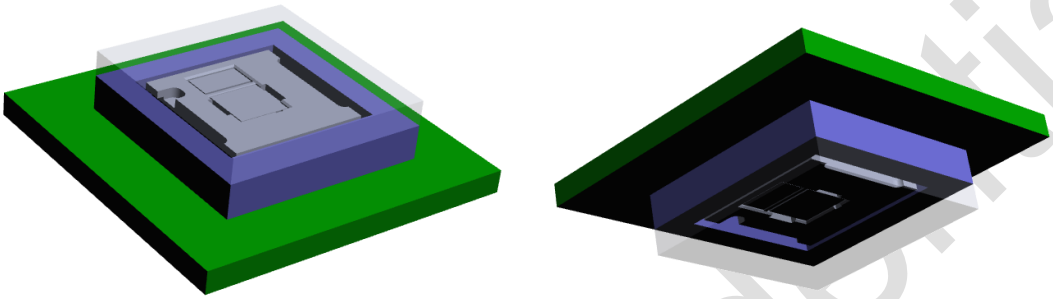

Figure 1. Complete Module Assembly

2.1 Signal Connectivity

To perform the Signal Connectivity test:

1. Write value 0x02 to register 0x7F. Read back the written value in this register, which expect to return 0x02.
2. Write value 0x00 to register 0x7F. Read back the written value in this register, which expect to return 0x00.
3. Read register 0x00. Read back value should be 0x4F.
4. Read register 0x5F. Read back value should be 0xB0.
5. The Signal Connectivity test is completed and passed when all the write and read register values are correct (as indicated above).

2.2 LASER Test

1. Place the module on a normal white paper, inside a non-reflective black color shielding box (Refer to Figure 2).

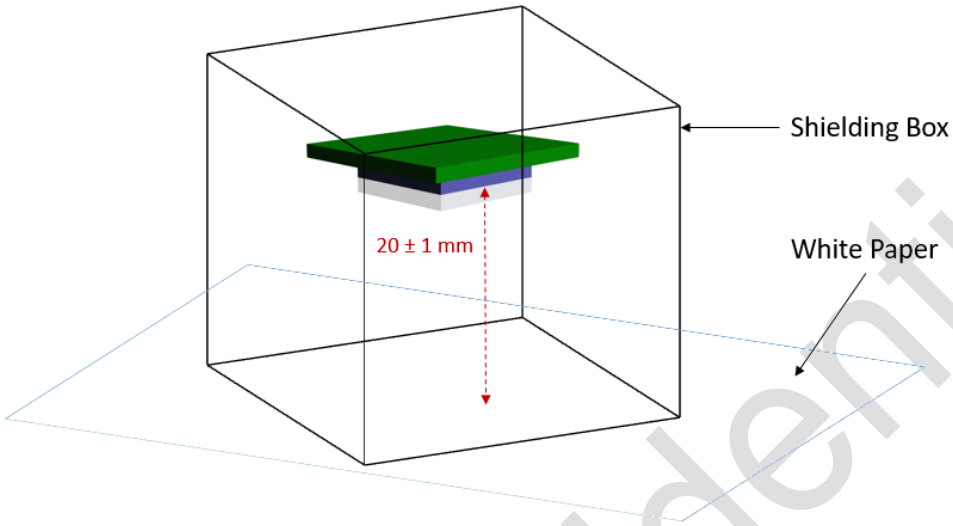

Figure 2. Recommended Test Set-up

Note: The module must be static and do not move or vibrate the module during testing.

2. The function of the black color shielding box is to minimize the interference of ambient light to the module during testing.

3. It is recommended to set the distance from the top of the chip to the surface (white paper) as 20 ± 1 mm. With the recommended setup of protective cover stated in the datasheet and assuming the gap is 0.7mm, then the distance from the protective cover should be 18.2 ± 1 mm.

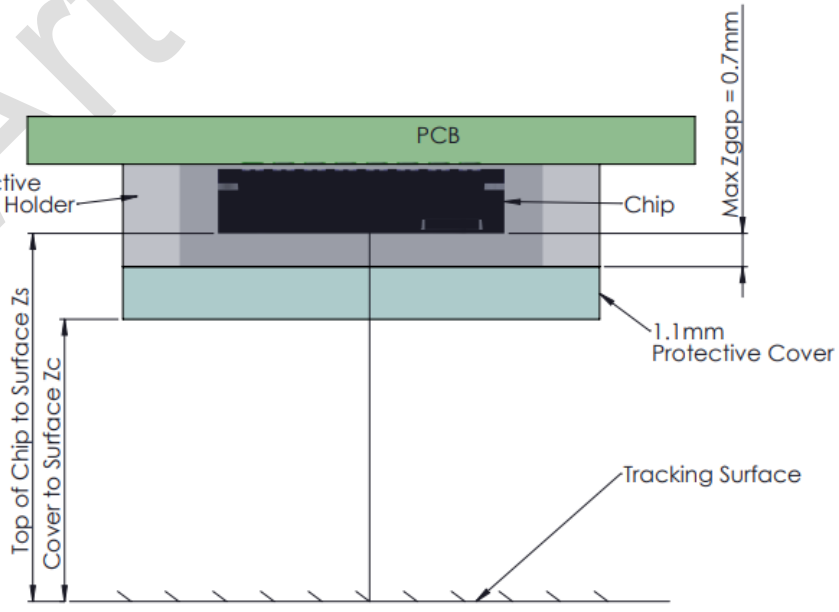

Figure 3. Distance from the Protective Cover to Surface

4. Perform registers initialization process. Refer to Performance Optimization Setting in the respective chip's datasheet.

5. To perform LASER Test:
   a. Laser is turned ON after register initialization, delay for 10ms. Read Squal (SQ) register (address 0x07) and Shutter (SH) registers (address 0x0B and 0x0C).
      - Pass criteria: SQ ≥ 152 and SH < 884
   b. Follow below procedure for laser OFF Test
      I. Write value 0x15 to register 0x7F
      II. Write value 0x80 to register 0x62
      III. Write value 0xD0 to register 0x64
      IV. Delay for 10ms
      V. Read Squal (SQ) register (address 0x07) and Shutter (SH) registers (address 0x0B and 0x0C)
         - Pass criteria: SQ < 152 and SH = 884

Note: After Laser is turned OFF, there is a need to perform the full register initialization again to turn it back ON.

2.3 Contamination Test

1. Appropriate surface is needed for Contamination Test, where glossy tile is recommended.

Glossy tile (Top view)

Glossy tile (Side view)

Figure 4. Recommended Surface for testing environment

2. It is recommended to fabricate a sliding rail (manual or automated) to mount the module for performance validation. The travel distance should be within 20 to 50 cm. The distance between the top surface of the chip and the test surface should be 20 ± 1 mm or distance between the top surface of protective cover to the test surface is 18.2 ± 1 mm, with recommended setup stated in the datasheet.

3. Note that different registers setting need to be applied for the different chips (PAT9136E1 vs PAA5160E1) prior to this test. Refer to Performance Optimization Setting in the respective chip's datasheet.

4. Move the module across the recommended travel distance over the recommended surface.

5. Read delta X and delta Y to obtain the total accumulated counts. The following is a sample code in retrieving the delta X/Y motion count.

```
// Read out delta X/Y motion
if( SPIRead(0x02) & 0x80 )   //check motion bit in bit7
{
        deltaX_l = (int16_t)SPIRead(0x03);
        deltaY_l = (int16_t)SPIRead(0x05);
        deltaX_h = ((int16_t)SPIRead(0x04))<<8;
        deltaY_h = ((int16_t)SPIRead(0x06))<<8;
 }
 *dx = deltaX_h | deltaX_l;
 *dy = deltaY_h | deltaY_l;
```

6. Verify the total accumulated counts obtained against specification (specification for total accumulated counts is defined from data collected during initial production trial runs).

Revision History

Revision Number	Date	Description
1.0	22 Dec 2023	Initial release