

# ASA10080-97 – Generic Datasheet

---

*Shape Memory Alloy Closed-Loop Auto-Focus Actuator*

CONFIDENTIAL and PROPRIETARY  
PRELIMINARY

Distribution: CONFIDENTIAL

Date: April 18<sup>th</sup>, 2016  
Version: 0.1

## Publish and Distribution Accounts

Approval	Sales	PM	QA	EE	ME	Process
Ethan.C	E. Liao	Gordon. C	Hannah. W	J. Lin	R. Hu	T. Nicolaisen

## Revision History

Rev.	Date	Prepared by	Description
0.1	June 18 <sup>th</sup> , 2015	Gordon Chu	• Initial release
			•
			•
			•
			•
			•
			•
			•
			•
			•
			•
			•
			•
			•

CONFIDENTIAL

## Table of Contents

<b><i>Publish and Distribution Accounts</i></b>	<b><i>1</i></b>
<b><i>Revision History</i></b>	<b><i>1</i></b>
<b><i>Table of Contents</i></b>	<b><i>2</i></b>
<b><i>Table of Figures</i></b>	<b><i>2</i></b>
<b><i>1 Overview</i></b>	<b><i>3</i></b>
1.1 ASA10080-97 General Specifications	3
1.2 Actuation Principle	3
1.3 Closed Loop Control	4
1.4 Typical Application Circuit	5
<b><i>2 ASA10080-97 Performance Specifications</i></b>	<b><i>6</i></b>
<b><i>3 Reliability Tests Specifications</i></b>	<b><i>7</i></b>
<b><i>4 ASA10080-97 Dimension and Appearance Specifications</i></b>	<b><i>12</i></b>
4.1 Dimensions Specifications	12
4.2 Appearance Specifications	13

## Table of Figures

Figure 1: SMA Wire Operation Principle	3
Figure 2: SMA Actuator Principle	4
Figure 3: ASA10080-97 Typical Application Circuit	5
Figure 4: ASA10080-97 2D Drawing	12
Figure 5: ASA10080-97 Actuator – 3D View	13

## 1 Overview

ASA10080-97 is a closed loop autofocus actuator that can be integrated into mobile phone camera systems. The actuation force is provided by a Shape Memory Alloy (SMA) wire. The closed loop control is performed by the embedded driver IC and Hall sensor BU64748GWZ produced by Rohm.

This document provides a general description of the actuator as well as standard performance and reliability specifications. These specifications can be modified to meet customer's requirements after agreement between both parties.

### 1.1 ASA10080-97 General Specifications

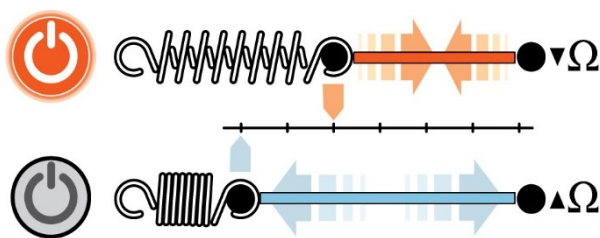
**Table 1: ASA10080-97 General Specifications**

Items	Specifications
Dimension (X, Y, Z) <sup>(1)</sup>	10 mm x 10 mm x 4 mm
Barrel Diameter	Φ8 mm
Actuator weight (without lens)	≤ 0.40g
DC resistance of SMA wire	25 ± 1Ω
Position Feedback	Hall Sensor
Operation temperature	-30°C~70°C
Storage Environment	-40°C~35°C 10~90% RH
Max clamping force for active alignment	15N (1.5kgf)

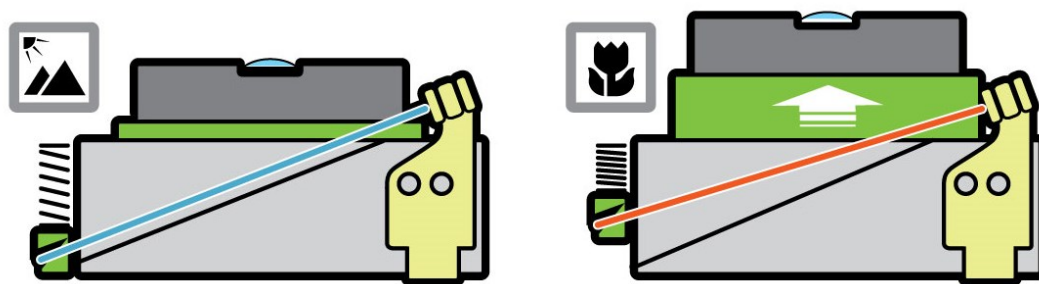
### 1.2 Actuation Principle

When current flows into the SMA wire, the SMA wire starts to shrink and overcomes the bias spring force. When the current is cut off, the bias spring force overcomes the SMA wire force, as shown in Figure 1.

**Figure 1: SMA Wire Operation Principle**



<sup>(1)</sup> Detailed dimension please see the drawing in section 4.



**Figure 2: SMA Actuator Principle**

Figure 2 shows the SMA wire on the actuator. When the current is cut off, the Lens stays in the INF position. When the current flows into the SMA wire, the Lens moves toward the Macro position. The Lens position is controlled by the Magnet on the Lens Carrier and the hall sensor integrated driver IC.

### 1.3 Closed Loop Control

Rohm combined driver IC and Hall sensor (BU64748GWZ) is embedded into the autofocus actuator. This means that no driver IC is required onto the CMOS sensor FPC/PCB.

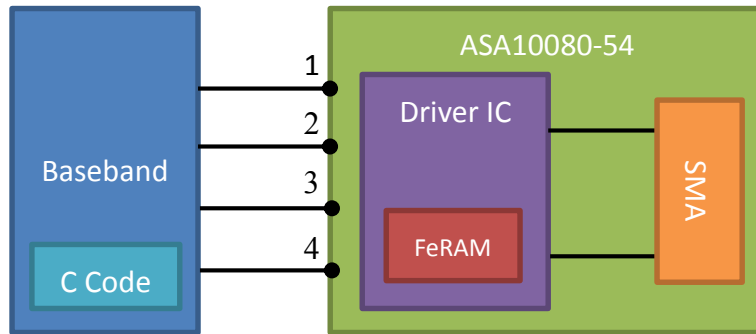
An initialization file is saved into the baseband with all the required driver IC settings (eg: PID settings for closed loop). When the camera is switched on, the baseband transfers all settings to the driver IC register.

Optional: Different PID settings can be used for forward and backward motions and increase the actuator performance. To enable this option, the baseband has to transfer the correct PID settings to the driver IC each time that the motion direction is changed.

**Table 2: BU64748GWZ Features**

Features	Characteristics	
Built in Hall Sensor		
Driver	H-Bridge Output Current (Max 150mA)	
2-Wire Serial Interface	I <sup>2</sup> C address	0xEEh (W), 0xEDh (R)
Fully Digital Equalizer		
Gain Adjustment for Hall Sensor		
Thermal Shut Down (TSD), Under Voltage Locked Out (UVLO)		
Built in small Capacity Ferroelectric RAM (FeRAM)	10 Byte (for User)	8 Byte (Calibration)
Supply Voltage	2.4 to 3.8V	

## 1.4 Typical Application Circuit



**Figure 3: ASA10080-97 Typical Application Circuit**

Electrical connection to the driver IC is made through 4 pads (pad 1 to pad 4). The pads are defined in Table 3. A FeRAM non-volatile memory is embedded into the driver IC. The Hall sensor calibration is executed in ASG factory and stored into the FeRAM.

A C code program provided by the driver IC supplier should be implemented into the baseband. When the camera is turned ON, the C code program retrieves the calibration data from the FeRAM through I<sup>2</sup>C communication and then updates the Driver IC registers.

**Table 3: ASA10080-97 Pads definition**

Pin	Label	Remarks
1	SDA	Data of I <sup>2</sup> C Interface
2	SCL	Clock of I <sup>2</sup> C Interface
3	GND	Ground
4	VCC	Power Input : Typical 2.8V

## 2 ASA10080-97 Performance Specifications

For all performance measurements, the actuator motion is along the Z axis in the upward direction. The following specifications are given for standard environment conditions:

- Temperature:  $25 \pm 2^{\circ}\text{C}$
- Relative Humidity:  $50 \pm 20\% \text{ RH}$

**Table 4: ASA10080-97 Performance Specifications**

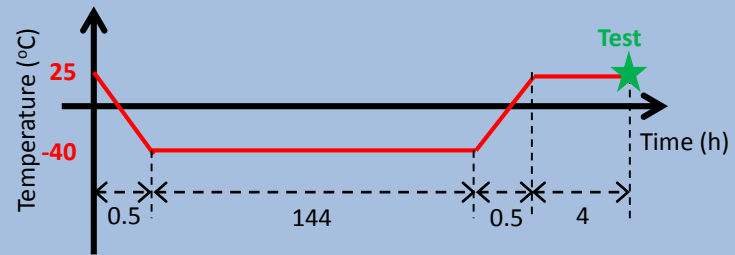
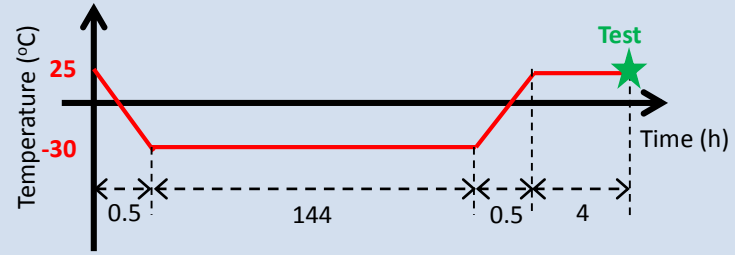
Items		Specifications
Usable Stroke		$\geq 350\mu\text{m}$
Operation power consumption (operating current, $I_{\text{RMS}} < 56\text{mA}$ )		$< 150\text{mW}^{(2)}$
Max power consumption	SMA wire (at 350um stroke)	$\leq 220\text{mW}$
	Driver IC	$\leq 30\text{mW}$
Actuator moving time	step size: 30um	$< 20\text{ms}$
Dynamic Tilt (from 0um to 350um stroke)		$< 8 \text{ minutes}$
Hysteresis		$\leq 10\mu\text{m}$
Accuracy		$\pm 5\mu\text{m}$
Posture difference		$< 15\mu\text{m}$
Peak Audible noise (1cm from Actuator)		$< 20\text{dBA}$ (background noise only)

<sup>(2)</sup> In closed-loop control.

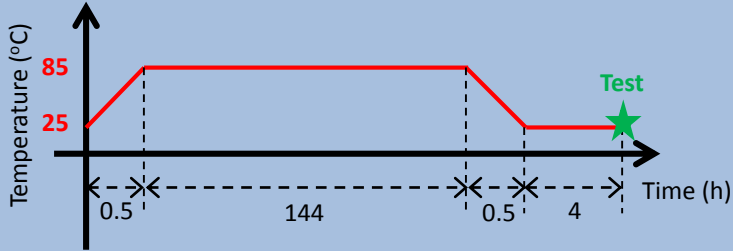
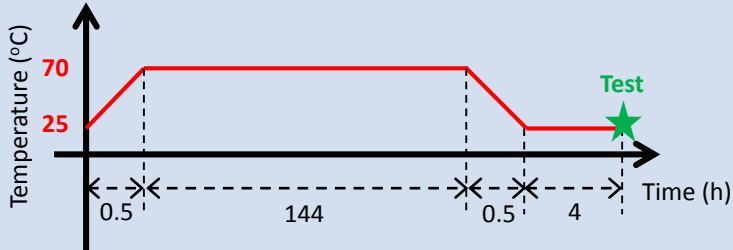
### 3 Reliability Tests Specifications

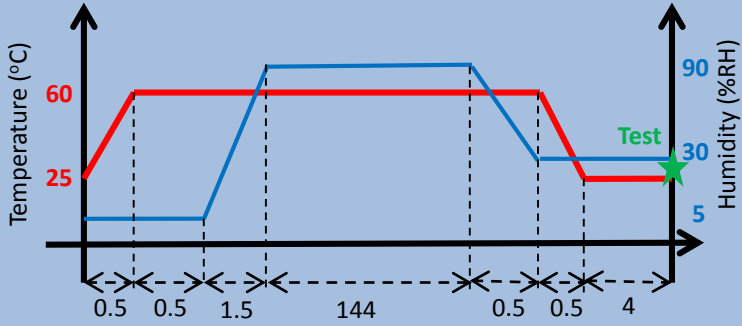
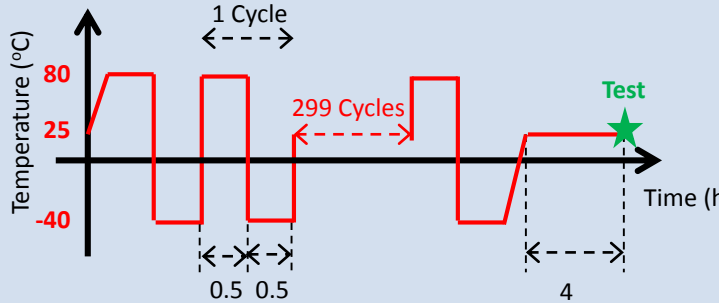
The test quantity is 20 pieces for each item. The actuator should meet the general specifications and performance specifications after reliability test.

Table 5: Thermal Reliability Tests Specifications

Thermal Tests	Specifications
Cold Storage	<div> <div> (1) Storage Temperature: <math>-40\pm 2^{\circ}\text{C}</math>  (2) Temperature Ramp: <math>2^{\circ}\text{C}/\text{min}</math>  (3) Storage Time: 144hrs  (4) Temperature Cycle Count: 1 cycle  (5) Actuation Signal: None  (6) Actuation Period: NA  (7) Actuation Count: NA  (8) Lens Weight: NA  (9) Testing Temp. &amp; Humidity: <math>25\pm 5^{\circ}\text{C}</math>, <math>50\pm 20\%</math> RH </div> <div>  </div> </div>
Cold Operation	<div> <div> (1) Operation Temperature: <math>-30\pm 2^{\circ}\text{C}</math>  (2) Temperature Ramp: <math>2^{\circ}\text{C}/\text{min}</math>  (3) Operation Time: 144hrs  (4) Temperature Cycle Count: 1 cycle  (5) Actuation Signal: square wave <math>0\mu\text{m} \rightarrow 350\mu\text{m}</math>  (6) Actuation Period: 15sec@<math>0\mu\text{m}</math>, 15s@<math>350\mu\text{m}</math>  (7) Actuation Count: 17280  (8) Lens Weight: 0.18g  (9) Testing Temp. &amp; Humidity: <math>25\pm 5^{\circ}\text{C}</math>, <math>50\pm 20\%</math> RH </div> <div>  </div> </div>



Thermal Tests	Specifications	
Dry Heat Storage	(1) Storage Temperature: $85\pm 2^{\circ}\text{C}$ (2) Temperature Ramp: $2^{\circ}\text{C}/\text{min}$ (3) Storage Time: 144hrs (4) Temperature Cycle Count: 1 cycle (5) Actuation Signal: None (6) Actuation Period: NA (7) Actuation Count: NA (8) Lens Weight: NA (9) Testing Temp. & Humidity: $25\pm 5^{\circ}\text{C}$ , $50\pm 20\%$ RH	
Dry Heat Operation	(1) Storage Temperature: $70\pm 2^{\circ}\text{C}$ (2) Temperature Ramp: $2^{\circ}\text{C}/\text{min}$ (3) Operation Time: 144hrs (4) Temperature Cycle Count: 1 cycle (5) Actuation Signal: square wave $0\mu\text{m} \rightarrow 350\mu\text{m}$ (6) Actuation Period: 15sec@ $0\mu\text{m}$ , 15s@ $350\mu\text{m}$ (7) Actuation Count: 17280 (8) Lens Weight: 0.18g (9) Testing Temp. & Humidity: $25\pm 5^{\circ}\text{C}$ , $50\pm 20\%$ RH	

Thermal Tests	Specifications
Temperature & Humidity Storage	<div data-bbox="539 292 1189 711"> <p>(1) Storage Temp. &amp; Humidity: <math>60\pm 2^{\circ}\text{C}</math>, <math>90\pm 5\%</math> RH</p> <p>(2) Temperature Ramp: <math>2^{\circ}\text{C}/\text{min}</math></p> <p>(3) Storage Time: 144hrs</p> <p>(4) Temperature Cycle Count: 1 cycle</p> <p>(5) Actuation Signal: None</p> <p>(6) Actuation Period: NA</p> <p>(7) Actuation Count: NA</p> <p>(8) Lens Weight : NA</p> <p>(9) Testing Temp. &amp; Humidity: <math>25\pm 5^{\circ}\text{C}</math>, <math>50\pm 20\%</math> RH</p> </div> <div data-bbox="1285 384 2024 711">  </div>
Thermal Shock (Storage)	<div data-bbox="539 727 1189 1190"> <p>(1) High Storage Temperature: <math>85\pm 2^{\circ}\text{C}</math> Low Storage Temperature: <math>-40\pm 2^{\circ}\text{C}</math></p> <p>(2) Temperature Ramp: <math>&lt; 3\text{min}</math></p> <p>(3) Temperature Holding Time: 30min</p> <p>(4) Temperature Cycle Count: 300 cycles (1hr/cycle)</p> <p>(5) Actuation Signal: None</p> <p>(6) Actuation Period: NA</p> <p>(7) Actuation Count: NA</p> <p>(8) Lens Weight: NA</p> <p>(9) Testing Temp. &amp; Humidity: <math>25\pm 5^{\circ}\text{C}</math>, <math>50\pm 20\%</math> RH</p> </div> <div data-bbox="1308 839 2024 1142">  </div>

**Table 6: Mechanical Reliability Tests Specifications**

Mechanical Tests	Specifications
Vibration Test	(1) 10-55Hz sweep sine wave (2) Direction: X, Y, Z directions (3) Sweep time (10~50~10): 2min (4) Amplitude 2mm (p-p) (5) Time: 30min each direction
Life Test	(1) Operation Temp. & Humidity: 25±5°C, 50±20% RH (2) Actuation Signal: square wave 0um → 350um (3) Actuation Period: 0.1s@0um, 0.1s@350um (4) Actuation Count: 100,000 (5) Lens weight: 0.18g (6) Testing Temp. & Humidity: 25±5°C, 50±20% RH
Drop Test	(1) Testing Temp. & Humidity: 25±5°C, 50±20% RH (2) Drop Height: 1.6m (3) Drop Count: 6 Drops per cycle (6 faces) (4) Cycle Count: 3 Cycles (5) Lens weight: 0.18g (6) Fixture weight: 148g (7) Drop Surface: steel
Tumble Test (Random Free Fall)	(1) Drop Height: 1m (2) Rotation Speed: 8rpm (3) Rotation Count: 200 rotations (400 drops) (4) Lens weight: 0.18g (5) Fixture Weight: 148g (6) Drop Surface: steel
Repeat Low Level free fall test (with lens unit)	(1) Drop Height: 8cm (2) Drop Directions: Top, bottom, side (3) Cycle Count: 10000 Cycles for top and bottom 2500 Cycles for side (4) Lens weight: 0.18g (5) Fixture weight: 148g (6) Drop Surface: steel

Mechanical Tests	Specifications
Pressure Test	(1) Pressure: 5kg (2) Holding time: 15sec (3) Direction: Normal to Top surface
Shield can pull out test	(1) Pull out force $\geq$ 2kg (2) Equipment: Force Gauge

CONFIDENTIAL

## 4 ASA10080-97 Dimension and Appearance Specifications

### 4.1 Dimensions Specifications

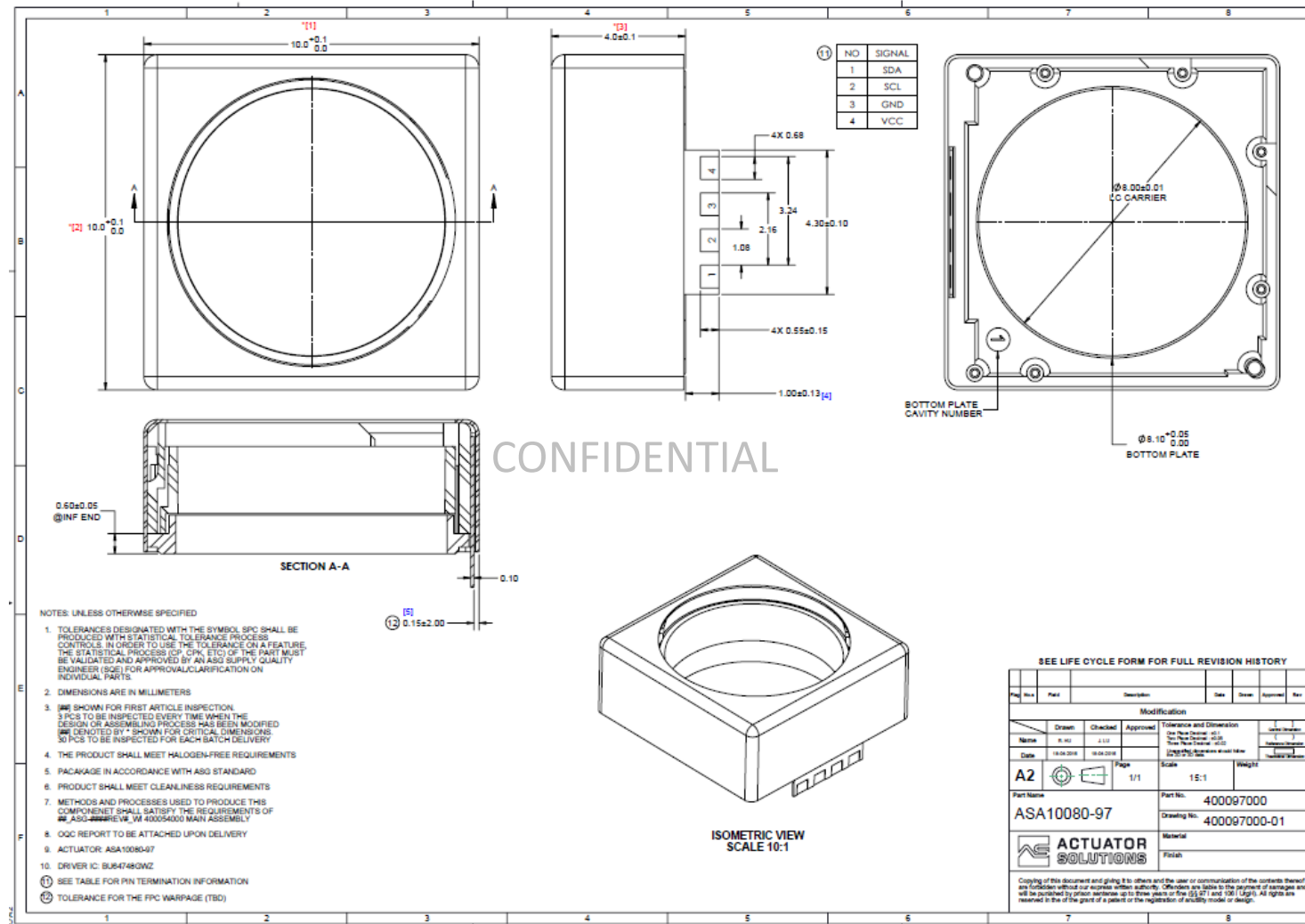


Figure 4: ASA10080-97 2D Drawing

## 4.2 Appearance Specifications

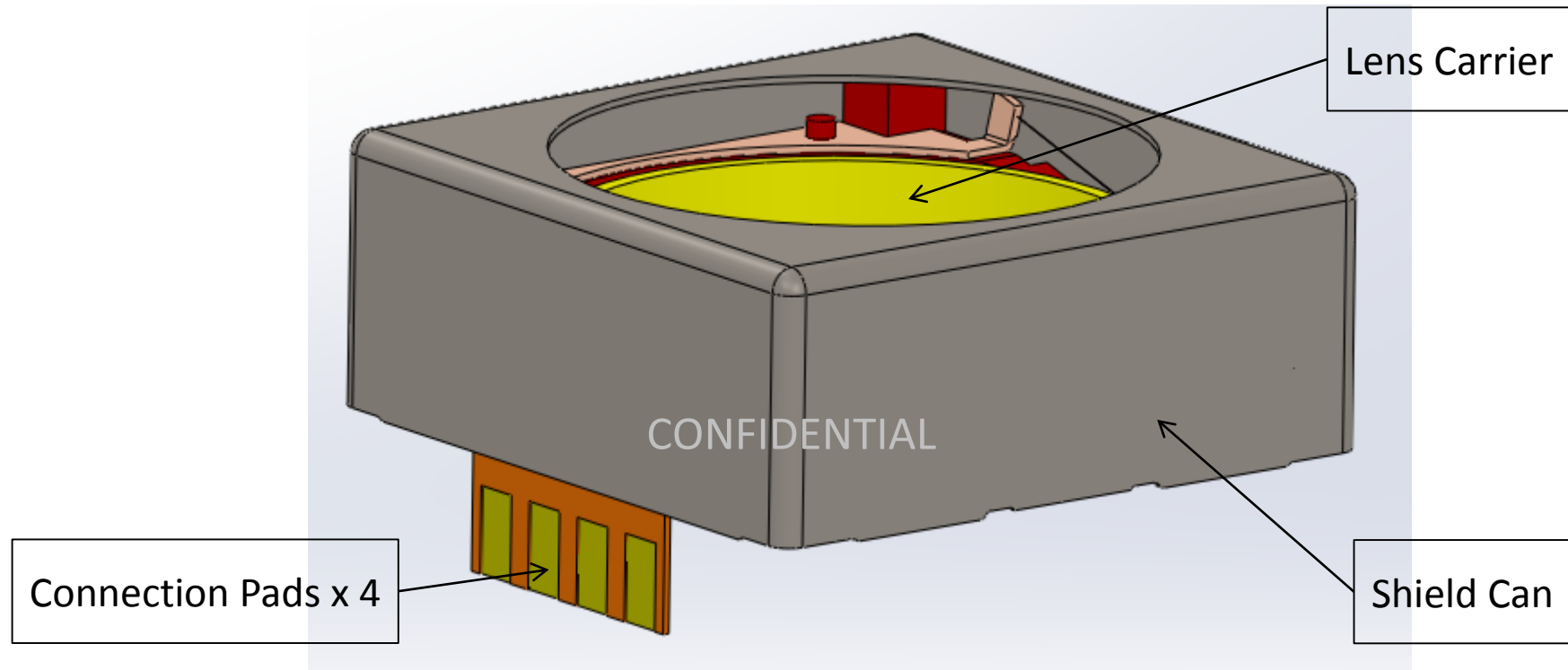


Figure 5: ASA10080-97 Actuator – 3D View

**Table 7: Appearance Specifications**

Item	Appearance Specification
Outer Appearance	Free of burrs > 0.05mm on side walls Free of burrs > 0.02mm on top and bottom faces Free of particles larger than 0.02mm Free of Rust, crack, discolor, stain, glue and solder residue Free of scratches larger than 0.05mm width
Lens Carrier Screw	Free of cracks Free of burrs > 0.020mm
Flexure	No discolor or rust No floating
FPC Pad	Free of oxidation Free of glue
Serial Number Label	No warp or tilt Clear to read

CONFIDENTIAL