Dual-axes Magnetic MEMS Mirror

MM2536-2, MM3242-2

Revision 1.1

January, 2025

Description

This manual describes the optical, electrical and mechanical specifications of the dual axis magnetic DC mirror.

The sercalo magnetic MEMS mirror are used for optical beam steering and scanning. The mirrors provide a large reflective surface up to 4.2×3.2 mm.

Using magnetic actuation, the deflection angle is set linearly with the driving current. The mirror is designed for DC operation as well as scanning.

1 Product Version

The dual axes deflection unit could be delivered with different mirror options such as coating (Gold or Aluminum) or mirror size.

2 Specifications

2.1 Mechanical interfaces

The following figures depict the device layout. All dimensions are in millimeters. As shown in the drawing (Figure 1), four tapped holes are provided to attach the deflection unit on a reference surface with M2 screws.

Table 2-1: Mechanical specifications

	Unit	Min	Typ	Max
Mass (without electronics)	g		6	
Dimensions (without connector)	mm^3	14.0 × 14.0 × 6.0		
Mirror dimension (D_X × D_Y) *MM2536* *MM3242*	mm^2	2.5 × 3.6 3.2 × 4.2		

RECOMMENDATIONS
I. Because the device is actuated by a constant magnetic field (i.e. magnets), one should be careful when using ferromagnetic tools (like screwdriver) near the device. Indeed, the tool could be attracted by the device.
II. For the same reason it is recommended to use nonmagnetic material near the device. Otherwise the magnetic flux could be deviated and performance loss could occur. If screws composed with a nonmagnetic material are available, we suggest fixing the device with it.

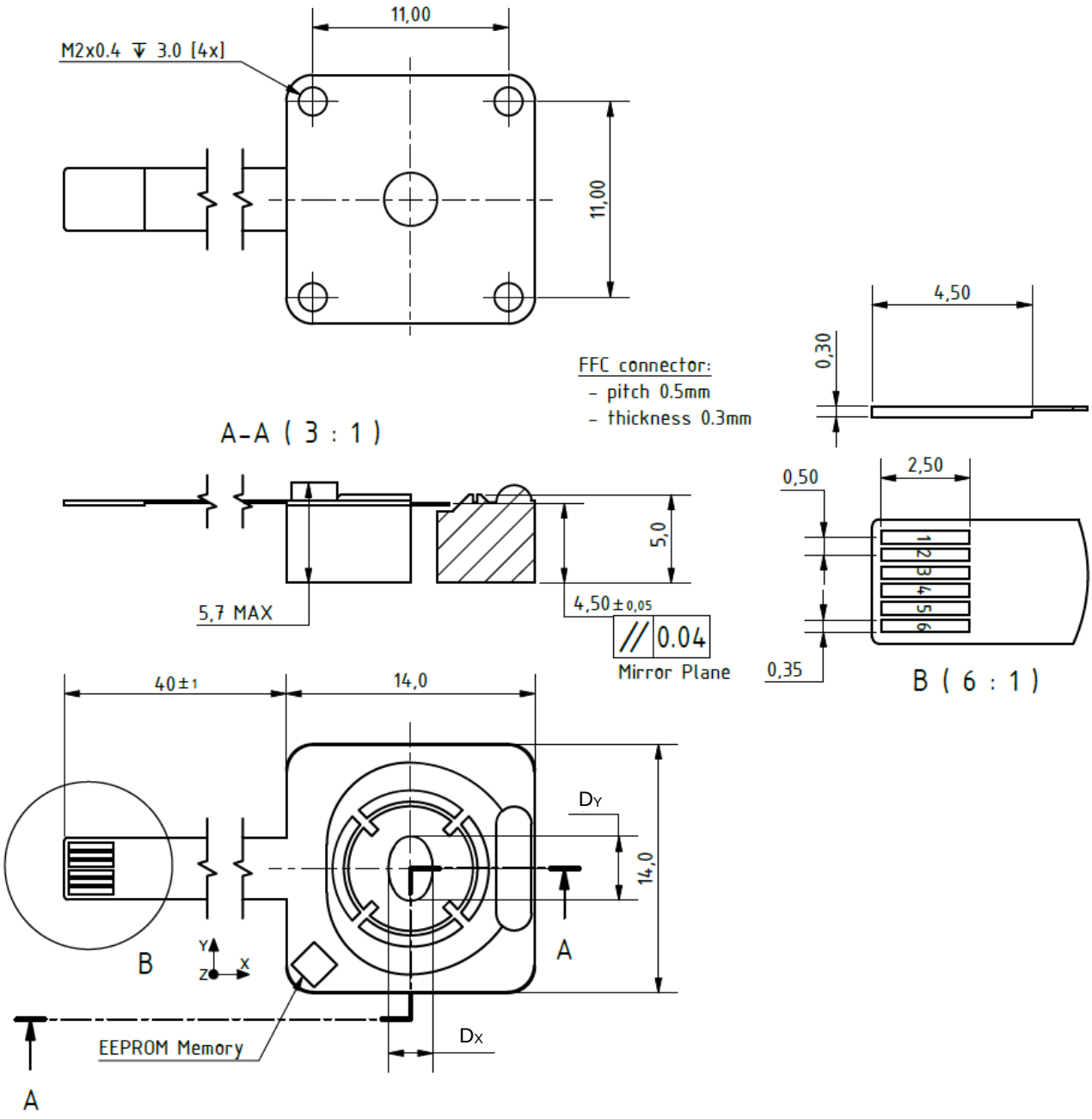


Figure 1: Dual-axes Magnetic MEMS mirror dimensions [mm]

2.2 Electrical interface

2.2.1 Standard option

In the option without optical feedback, a FFC connector is used to control the device and access its parameters through the EEPROM 1-wire interface.

Table 2-2: FFC Connector Pin Assignment

PIN	Name	Description
1	X+	X axis coil positive input
2	X-	X axis coil negative input
3	Y+	Y axis coil positive input
4	Y-	Y axis coil negative input
5	GND	Ground
6	DATA	EEPROM 1-Wire Line

2.3 Mirror Actuation

The mirror is actuated by two coils moving in a constant magnetic field. The mirror is driven linearly with the current.

For controlling the device, a voltage driver could be implemented. The coil resistance should be taken into consideration for the open-loop controller.

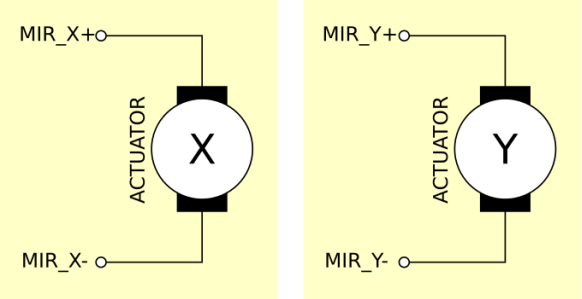


Figure 2: Mirror driving actuators electrical scheme

Table 2-3: MM2536-2 Actuators specifications

	Unit	Min	Typ	Max
Supply Current (Axis X)	mA/°		33	
Supply Current (Axis Y)	mA/°		30	
Power consumption (Total)	mW			600
Coil Resistance (Axis X)	Ω		10	
Coil Resistance (Axis Y)	Ω		10	
Resonnance Frequency (Axis X)	Hz	350		400
Resonance Frequncy (Axis Y)	Hz	200		250
Tilt Angle Range (both axes)	°	-5		5

Table 2-4: MM3242-2 Actuators specifications

	Unit	Min	Typ	Max
Supply Current (Axis X)	mA/°		33	
Supply Current (Axis Y)	mA/°		30	
Power consumption (Total)	mW			600
Coil Resistance (Axis X)	Ω		10	
Coil Resistance (Axis Y)	Ω		10	
Resonnance Frequency (Axis X)	Hz	250		300
Resonance Frequncy (Axis Y)	Hz	200		250
Tilt Angle Range (both axes)	°	-3		3

The required current with an alternative source depends on the driving frequency. The closer the frequency is to the resonance, the lower should be the current. A measured set of gain values is provided within the product report sheet attached to each device. Additionally, the reported values are also saved in the device memory.

RECOMMENDATIONS

III. If the device is actuated in DC mode, a large current step could cause damage because of the overshoot of the mechanical response. To avoid any device failures, we strongly recommend:

- to limit the maximum current to 200mA
- to operate a current ramp of max 2A/s.

2.4 Mirror Coating

Two options are available for the mirror coating: Gold or Aluminum.

Table 2-5: Optical specifications

	Unit	Metallic	
		Gold	Aluminium
Operating Wavelength	nm	IR	Visible
Reflectivity	%	98% @1550nm	>88
Wavefront Error	nm	<300	<300
Rougness	nm	<1	<1.5

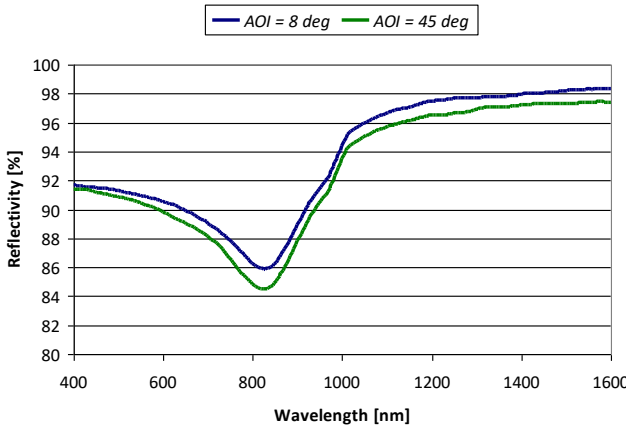


Figure 3: Typical reflectivity for Aluminum coated mirror in function of incidence angle

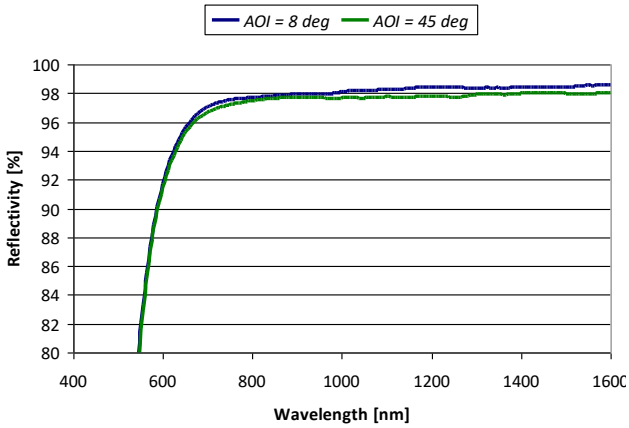


Figure 4: Typical reflectivity for Gold coated mirror in function of incidence angle

2.5 Environmental specifications

2.5.1 Thermal Environment

Table 2-6: Thermal Environment

	Unit	Min	Typ	Max
Operating Temperature	°C	-5		85
Storage Temperature	°C	-40		85

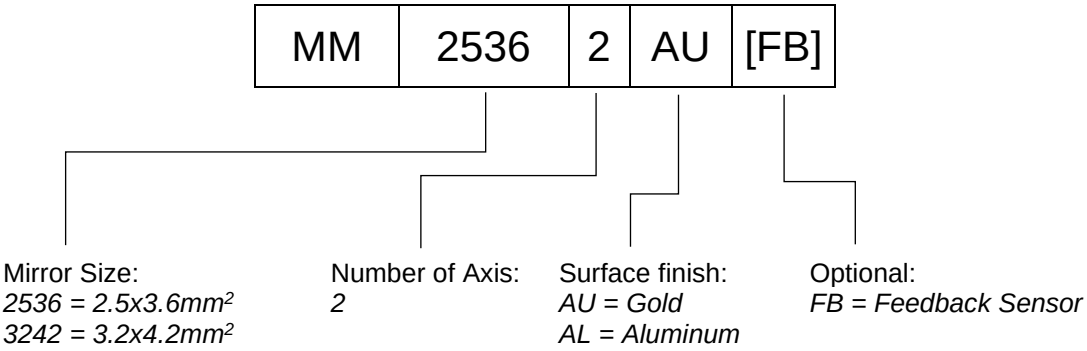
3 Absolute Maximum Ratings

Applicable absolute maximum ratings for the full operating temperature range without causing irreversible damage to the device are listed in Table 3-1.

Table 3-1 – Absolute maximum ratings

Parameter	Rating Limit	Unit
Maximum supply current per axis (DC)	200	mA
Maximum current ramp (DC) (see Recommendation III)	2	A/s

4 Label Information



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