



CAMBRIDGE
MECHATRONICS



SMA ACTUATORS FOR SMARTPHONE CAMERAS

SHAPE MEMORY ALLOY (SMA) PLATFORM TECHNOLOGY

Cambridge Mechatronics presents SMA actuator and camera solutions for smartphones, with compact and lightweight designs, a high force-to-mass ratio, and free of electromagnetic interference. These key features enable high performance and integration flexibility with the product selection influenced by factors such as size, moving mass, performance requirements and cost.

This eBook provides an overview and guidance on which SMA actuators are best suited for which camera application in a smartphone.

SMARTPHONE CAMERA SOCKETS

Smartphone customers want high quality image and video capture, free from motion blur, distortion and noise. Each camera slot has different use cases and requirements.

MAIN (WIDE ANGLE) CAMERA

Must cover most consumer use cases and performance requirements

ULTRAWIDE CAMERA

Increased field-of-view for cinematic and active modes

TELEPHOTO & PERISCOPE ZOOM CAMERA

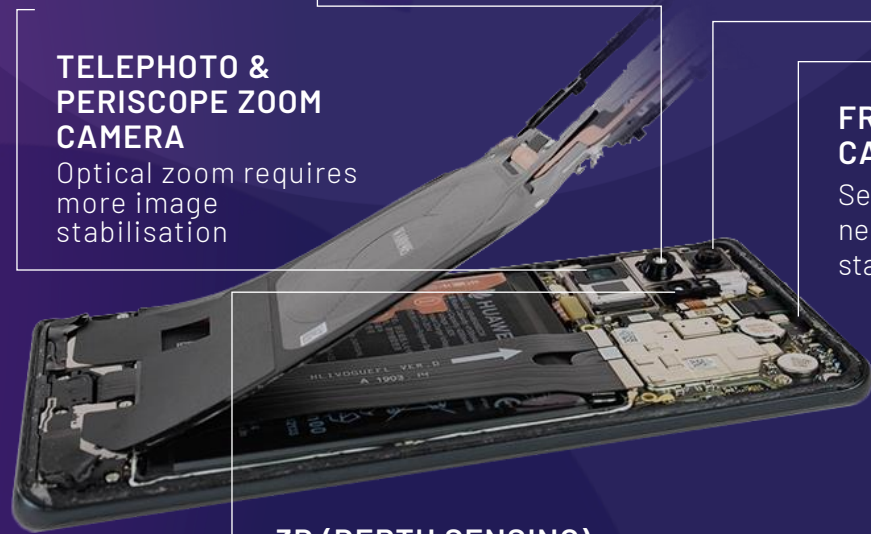
Optical zoom requires more image stabilisation

FRONT (SELFIE) CAMERA

Selfies and video calls need to be in focus and stable

3D (DEPTH SENSING) CAMERA

Available SMA technology - not covered in this eBook



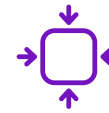
As camera components are getting larger, heavier and more complex, and consumers are looking to push the boundaries of performance, the advantages offered by SMA actuators become even more significant.



HIGH FORCE



ABILITY TO DRIVE HEAVIER LENSES



COMPACT AND LOW MASS



OCCUPIES LESS SPACE IN THE END PRODUCT



LOW POWER AND LOW VOLTAGE



LONGER BATTERY LIFE



PRECISE AND SILENT POSITIONING



ACCURATE MOVEMENT WITHOUT DISTRACTING NOISES



NO ELECTROMAGNETIC INTERFERENCE



DOESN'T INTERFERE WITH OTHER COMPONENTS UNLIKE VCM

ULTRAWIDE CAMERA (UW)

DOCUMENT GLOSSARY

OIS OPTICAL IMAGE STABILISATION

AF AUTOFOCUS

SMA LENS
SHIFT OIS

SMA SENSOR
SHIFT OIS

SMA LENS
SHIFT AF+OIS

SMA MODULE
TILT OIS

SMA
AF

SMA VARIABLE
APERTURE



SMA LENS SHIFT AF+OIS

This single actuator solution offers macro to infinity AF capability as well as OIS making it an attractive and cost-effective option to introducing OIS to the UW camera. Enabling OIS in the UW adds value when in video mode and allow seamless transfer between UW and main cameras during recording.



SMA MODULE TILT OIS

With the ability to handle higher amplitudes of movement, introducing Module Tilt OIS into the UW is ideal for enabling action camera functionality in a smartphone at a range of field-of-views. The SMA module tilt design, especially in combination with an ultra-slim SMA AF, means a compact form-factor can be achieved.



SMA AF

SMA AF is lower in z-height compared to traditional VCM AF solutions, enabling easier integration into folded and flip handset form-factors. SMA AF is particularly suited to a module tilt or gimbal tilt camera module where the pressure on module z-height is greatest.



TELEPHOTO & PERISCOPE CAMERAS

KEY CHALLENGE

Due to the longer lens focal length, a higher OIS stroke is needed. The particulars of the lens result in more mass and size which still require accommodating in a compact form factor for a smartphone.

SMA LENS SHIFT OIS	SMA SENSOR SHIFT OIS	SMA LENS SHIFT AF+OIS	SMA MODULE TILT OIS	SMA AF	SMA VARIABLE APERTURE
	✓				



SMA SENSOR SHIFT OIS FOR TELEPHOTO

This solution offers an ultra-slim form factor and up to 400 microns of stroke, significantly more than what VCM can currently deliver. Additionally, sensor shift technology provides roll compensation, an advantage over lens shift.

SMA SENSOR SHIFT OIS FOR PERISCOPE

SMA Sensor Shift OIS is uniquely adaptable to a wide range of periscope camera designs as the product functionality can be separated from the complexities of the optical array. This makes it universally compatible with any periscope design—regardless of the number of lenses, prisms, or other optical components involved. SMA Sensor Shift OIS can provide a higher stroke length than other market solutions, allowing for better image stabilisation, particularly useful for high-magnification periscope configurations. CML is exploring designs that enable both OIS and AF functionalities on the sensor to simplify the overall camera design and free it from dependencies on the specific architecture of the periscope camera.



SELFIE CAMERA

KEY CHALLENGE

There is growing interest in adding ultra-slim autofocus functionality to selfie cameras in smartphones. The challenge with selfie cameras is the need to minimise the thickness of the setup due to the display screen overlapping with the camera components, making it critical to maintain a low Z-height.

SMA LENS SHIFT OIS	SMA SENSOR SHIFT OIS	SMA LENS SHIFT AF+OIS	SMA MODULE TILT OIS	SMA AF	SMA VARIABLE APERTURE
		✓		✓	



SMA LENS SHIFT AF+OIS

A single actuator integrating both AF+OIS will improve the quality of selfie cameras, not just for better selfies but also for enhanced functionalities like video calls, particularly if the SMA solution is as slim as a VCM AF-only solution.



SMA AF

SMA AF can save a millimeter in z-height compared to traditional VCM AF. This may be crucial in certain design considerations, such as fitting the selfie camera underneath the display components in a handset.



MAIN CAMERA (WIDE-ANGLE)



SMA LENS SHIFT OIS	SMA SENSOR SHIFT OIS	SMA LENS SHIFT AF+OIS	SMA MODULE TILT OIS	SMA AF	SMA VARIABLE APERTURE



SMA LENS SHIFT OIS

CML's most mature solution providing the industry standard for image stabilisation. Many designs available following 5-years of mass production. Note that a separate AF is required.



SMA SENSOR SHIFT OIS

Stabilisation on the image sensor allows for the benefit of roll compensation. Sensor shift OIS is especially suited to larger image sensor format cameras as it means moving less mass.



SMA LENS SHIFT AF+OIS

This is the most cost-effective AF+OIS solution, integrating both AF and OIS in a single actuator and enabling variable aperture support. Coupling between the two functionalities can lead to some limitation in total performance.



SMA MODULE TILT OIS

Offers the highest amplitude shake compensation whilst providing the best image quality across the image. Especially effective for filming, active modes and in low-light conditions.



SMA AF

SMA AF can save a millimeter in z-height compared to traditional VCM AF solutions enabling handset thickness reduction for sleeker industrial designs or folded handset form-factors.



SMA VARIABLE APERTURE

The SMA Variable Aperture allows for better image quality through improved control over depth of field and intake of light in varying light conditions. Particularly applicable for large image sensor sizes.

CML'S SMA PLATFORM TECHNOLOGY

CML's SMA actuators and controller ICs enable the highest performance autofocus (AF) and optical image stabilisation (OIS) in leading smartphone cameras.

PRODUCT

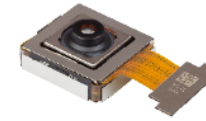
KEY FEATURE

DESIGN

KEY ATTRIBUTES

SMA MODULE TILT OIS

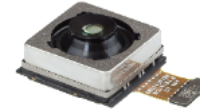
High angle suppression for a new era of high-quality movies



- Higher compensation angles
- Uniform suppression across the image
- Roll Capability
- Action camera suitability

SMA LENS SHIFT AF+OIS

World's first AF + OIS integrated single actuator



- Cost-effective
- Simpler design
- Single, unified AF & OIS control & integration
- Z-Height Efficiency

SMA SENSOR SHIFT OIS

Flagship camera spec, including roll suppression.



- Roll compensation
- Optimised performance for larger sensors
- Integration compatibility
- Superior low-light performance

SMA LENS SHIFT OIS

Tried and tested mature, high force, non-magnetic OIS actuator



- Product maturity & proven track record
- Simplicity of design & OIS cost efficiency
- Integration compatibility

SMA AF

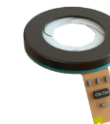
Lowest z-height product available



- Quick and accurate focussing
- Ultra-slim design
- Integration compatibility
- Enhanced video calls and selfies

SMA VARIABLE APERTURE

Very low mass, low power actuator delivering depth of field control



- Enhanced image quality
- Optimised light control
- Image processing resource savings
- Increased creative control



ABOUT CML

Cambridge Mechatronics Limited (CML) is a world-leading expert and developer of mechanical, optical, electrical, silicon and software designs for system-level solutions using Shape Memory Alloy (SMA) technology. Actuator solutions based on SMA wire can be controlled to sub-micron accuracy. These actuators are particularly suited to applications requiring fast motion, high precision and high force levels, in a compact and lightweight design.



CUSTOMER FOCUS

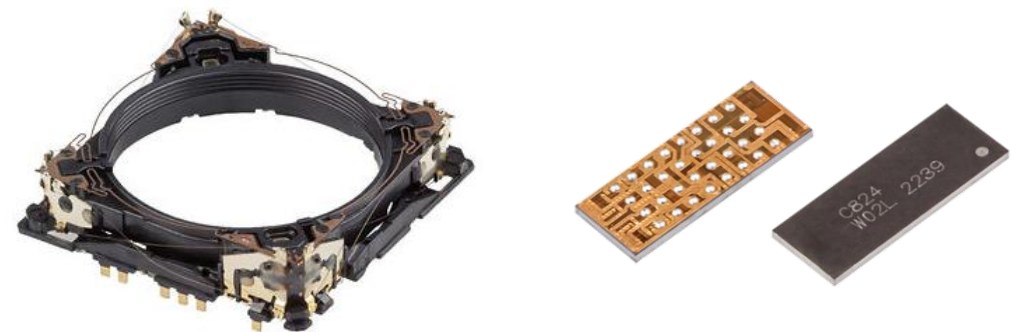
With substantial investment in SMA research and development over the past decade, CML has built a robust global patent portfolio of over 500 patents issued and pending worldwide.

CML is committed to continuous development of SMA actuators, targeting next-generation cameras to meet the roadmap aspiration of its global customer base.

COLLABORATION

CML collaborates with a wide network of partners including multinationals and their supply chains through technology development, transfer and production support to accelerate the commercialisation of SMA-based technology.

These programmes are collaborative and tailored to the individual requirements of our customers.





SMA PRODUCTS AND APPLICATIONS UNDER DEVELOPMENT

CAMERA

Continuous zoom enables smooth optical zoom without compromising on image sensor resolution.

AR/VR

Low power actuators for dynamic focus, thermal calibration and corrections; Display wobulation for super-resolution.

HAPTICS

Tactile sensations for smartphones, gaming consoles, and VR headsets. Compact, robust and able to simulating an array of real touch sensations.

MEDICAL

Enhancing the functionality of wearable drug delivery systems, capable of precise dosing and handling viscous fluids in medication formulations.

CONTACT US TO DISCUSS YOUR CAMERA REQUIREMENTS

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