CAMBRIDGE MECHATRONICS

SMA PRODUCT PORTFOLIO

CAMBRIDGE MECHATRONICS LTD'S SMA SOLUTIONS

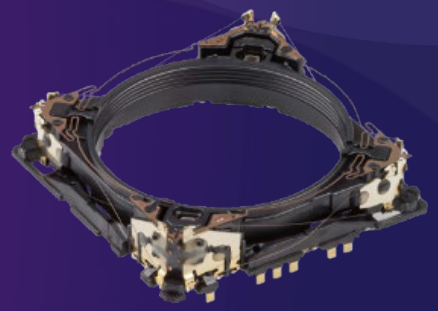
Cambridge Mechatronics Limited (CML) provides a diverse actuator product portfolio that leverages advanced Shape Memory Alloy (SMA) technology, integrating cutting-edge solutions across various applications from smartphone cameras to haptic feedback devices.

This eBook explores the products currently available for smartphone cameras and introduces SMA solutions under development for other industries.

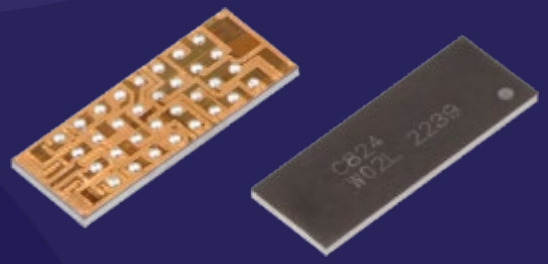
CML's SMA Platform Technology

Smartphone customers want high quality image and video capture, free from motion blur, distortion and noise.

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



SMA LENS SHIFT AF+OIS



CM824 SMA CONTROLLER IC

SMA actuator technology offers significant benefits through an unparalleled combination of high force-to-mass ratio and precision in a compact, low-power design, free of EMI.

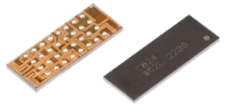
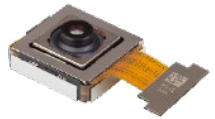
HIGH FORCE	ABILITY TO MOVE HEAVIER CAMERA ELEMENTS
COMPACT AND LOW MASS	OCCUPIES LESS SPACE IN THE END PRODUCT
LOW POWER AND LOW VOLTAGE	LONGER BATTERY LIFE
PRECISE AND SILENT POSITIONING	ACCURATE MOVEMENT WITHOUT DISTRACTING NOISES
NO ELECTROMAGNETIC INTERFERENCE	NO IMPACT WITH PROXIMAL EMI SENSISTIVE AND MAGNETIC COMPONENTS

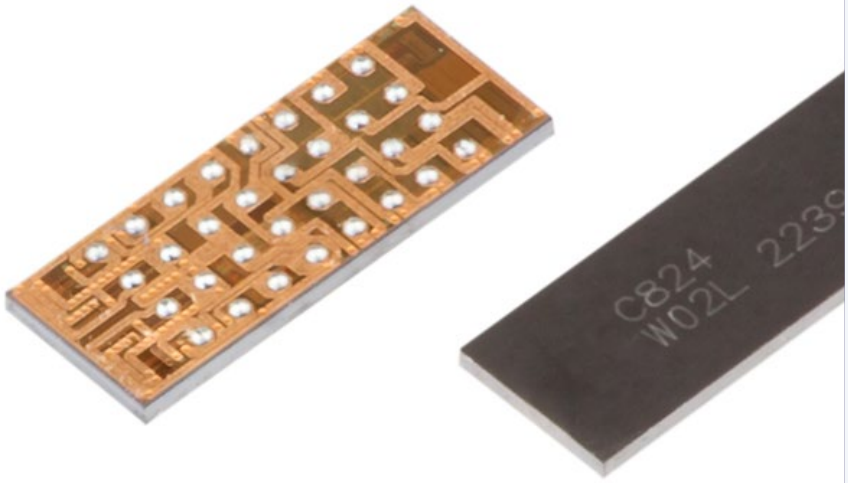
CML'S SMA CAMERA PRODUCTS

Smartphone cameras are getting larger and capable of more functionality.

Larger, heavier lenses and other components, such as a variable aperture, drive the demand for a high force technology like SMA.

The following pages describe the key features of CML's SMA products.

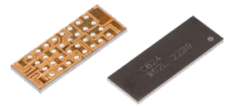
PRODUCT	KEY FEATURE	DESIGN	KEY ATTRIBUTES
CM824 CONTROLLER IC	Developed by **SMA experts**		▪ Ultimate system control and performance ▪ Fastest system integration & support
SMA LENS SHIFT AF+OIS	World's first **AF + OIS integrated** single actuator		▪ Cost-effective & simpler design ▪ Unified AF & OIS control & integration ▪ Z-Height Efficiency
SMA LENS SHIFT OIS	Tried and tested **mature, high force, non-magnetic** OIS actuator		▪ Product maturity & proven track record ▪ Simplicity of design ▪ Compatibility with new cameras
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
SMA SENSOR SHIFT OIS	Flagship camera spec, including **roll suppression**.		▪ Extra compensation axis: Roll motion ▪ Well suited for larger format sensors ▪ Integration compatibility for telephoto
SMA VARIABLE APERTURE	Very **low mass, low power** actuator delivering depth of field control		▪ Energy efficient ▪ No lens heating ▪ Compact and lightweight design
SMA AF	**Lowest z-height** product available		▪ Design flexibility ▪ Integration compatibility



CM824 Controller IC

CML's actuator designs, controller IC and firmware are co-developed as a single, optimised system. CM824 is the only IC developed by SMA experts for use with SMA actuators and firmware. The controller IC includes unique CML IP blocks.

Controller IC designed for SMA applications.



Latest Controller IC

CM824 is the latest chip designed for SMA actuator control and uses the latest technology to deliver performance and cost advantages.

Optimum Actuator System Performance

CML's Silicon IP enables actuator performance and features not available to competitor controller IC's, including the ability to deliver high levels of OIS handshake suppression over a range of common shake frequencies. CM824 also carries the highest MIPS capacity and Motion Processing specifications to support all current and future SMA actuator designs.

Fastest System Integration

CM824's unique hardware design enables more capable and faster implementation of solutions to eliminate image noise, seen when adopting new image sensors. Also, use of the CM824 Software Development Kit (SDK) significantly speeds up CCM production readiness and development of OEM handset camera apps.

Mass Production Ready

CM824 is qualified for mass production, in stock and available for product integration.

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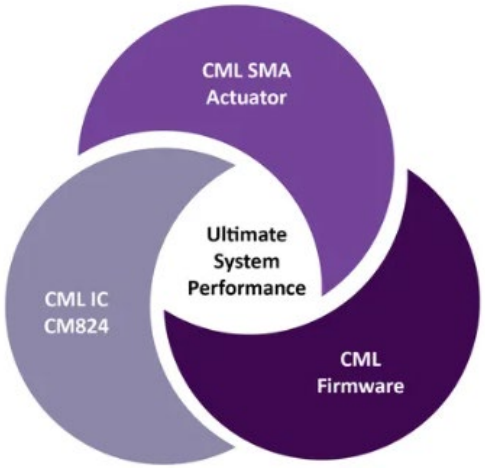

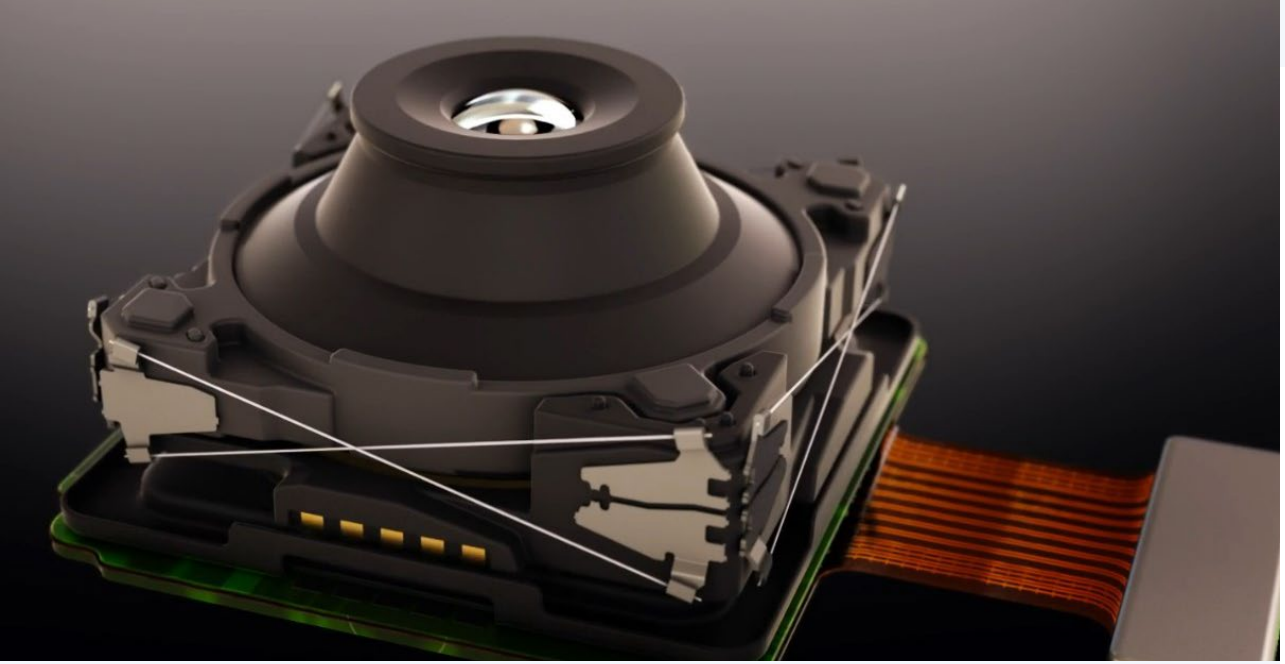

SMA LENS SHIFT AF+OIS

The Lens Shift AF+OIS solution integrates both AF and OIS into a single actuator. This simple design and low bill of materials offers a cost-effective solution designed for compact camera modules, providing high performance across the main (wide-angle), ultra-wide and selfie camera. High force SMA enables the addition of variable aperture to the camera module.

World's first AF + OIS integrated single actuator.

Cost-Effective

By integrating both AF and OIS into one actuator, the solution can reduce overall costs compared to separate systems, making it the most budget-friendly option within the SMA portfolio.

Simpler Design

The Lens Shift AF+OIS actuator involves fewer components and is easier to assemble, reducing manufacturing complexities. Its simpler design allows for quicker integration into existing camera systems.

Unified Control

With AF and OIS functionalities being part of the same system, it's easier to coordinate and control these features. This makes for a more efficient operational experience.

Z-Height Efficiency

The integration allows for more effective use of space (z-height), particularly beneficial for main cameras, where lens size might otherwise add significant thickness to the camera module, such as in folding handsets.

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SMA LENS SHIFT OIS

Lens Shift OIS is a mature OIS solution for the main (wide-angle) smartphone camera, offering a reliable and effective means to enhance image quality. Its advantages are particularly evident when increased payloads for large image sensor format cameras require stabilisation

High force, non-magnetic technology.

Maturity

With multiple deployments in flagship devices, Lens Shift OIS has a proven track record of enhancing image quality by reducing the blurring effects caused by unintended movements during photo capture. Lens Shift OIS has been integrated into multiple generations of smartphones and its maturity in the market signifies a level of proven effectiveness, reliability and confidence in adoption.

Simplicity

One of the strongest points of Lens Shift OIS is its simplicity. It focuses solely on providing optical image stabilisation, meaning that it can be precisely tuned for this function without any compromises.

Compatibility

Being a straightforward OIS solution, Lens Shift OIS can be more easily integrated into different smartphone camera architectures, including with competitor AF technologies. It doesn't require any complex alterations to the camera module, making it a flexible solution for many manufacturers. SMA lens shift OIS is a slim and compact solution.

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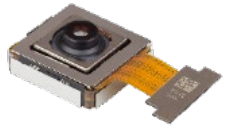
SMA MODULE TILT OIS

Module Tilt OIS represents the pinnacle of OIS technology, offering unparalleled high-angle stabilisation and control for video capture, where image quality remains uncompromised.

Module Tilt OIS provides high-angle suppression for a new era of high-quality movies.



Higher Compensation Angles

Module Tilt OIS is capable of 5 degrees of OIS compensation angle, outperforming traditional OIS methods that typically operate at 1 degree, and in a few use cases up to 3 degrees. The high compensation angle is crucial for applications involving high amplitudes of movement or shake, such as running. SMA Module Tilt OIS ensures effective suppression and better image or video quality.

Superior Low-Light Performance

The higher angle compensation and better suppression across the image mean that SMA Module Tilt OIS performs exceptionally well in low-light conditions, significantly reducing blur and improving image quality. In video mode, the improved stabilisation from SMA Module Tilt OIS potentially allows the use of higher frame rates.

Uniform Suppression Across the Image

Unlike traditional OIS systems that offer strong suppression in the centre of the image but sometimes weaker towards the edges, Module Tilt OIS provides a flat-line suppression performance across the entire image frame. This translates to consistently high image quality, irrespective of the frame region.

Roll Capability

In addition to the standard OIS functions, Module Tilt OIS also adds roll capability, enhancing the overall stabilisation and making it a comprehensive solution for various imaging challenges.

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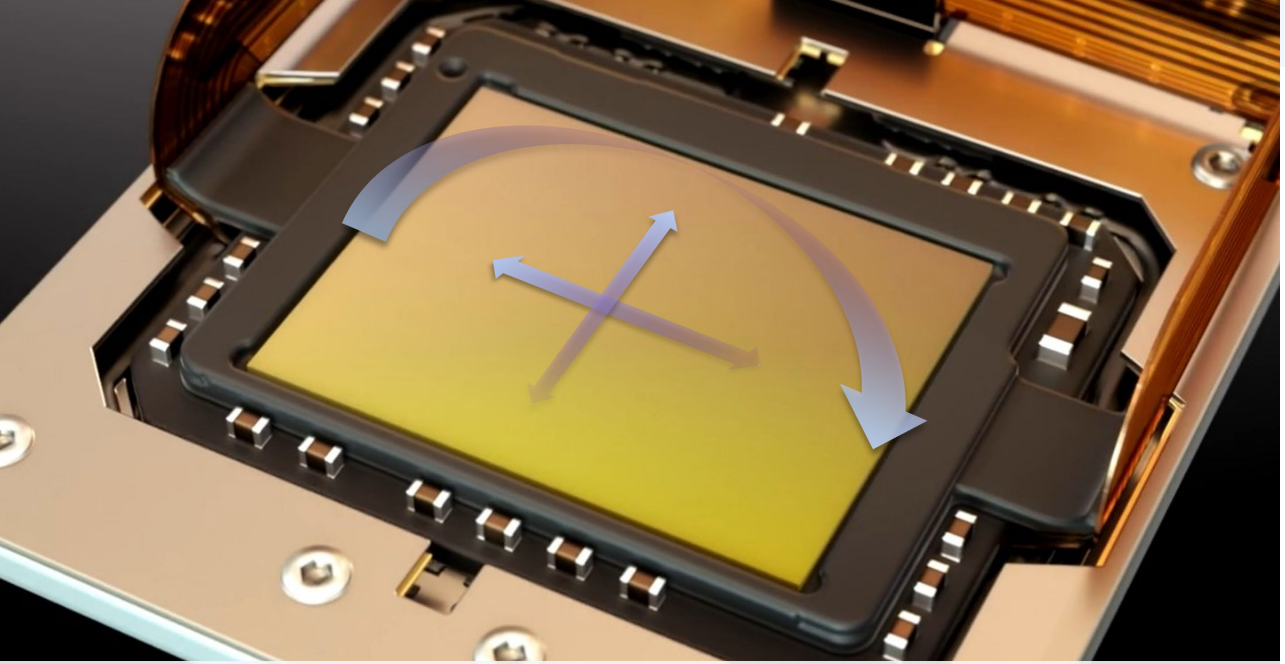

SMA SENSOR SHIFT OIS

Sensor Shift OIS offers unique advantages, especially when dealing with large or complex lens systems, making it a flagship solution for main (wide-angle), telephoto, and periscope cameras in high-end smartphones. Unlike traditional lens shift technologies, Sensor Shift OIS enables roll compensation.

Flagship camera spec, including roll suppression.

Roll Compensation

In addition to X- and Y-shift motion, Sensor Shift OIS is able to provide roll compensation, adding an extra axis of motion compensation to deliver improved images and video quality.

Telephoto Camera

Sensor Shift OIS is capable of meeting the demands for higher compensation motion required for telephoto or periscope cameras with optical zoom. The compact form factor makes it an ideal candidate for such camera types.

Ease of Adoption

Sensor Shift OIS can work with a range of lens configurations and aperture sizes without requiring a change in actuator design. Its scalability and adaptability make it a versatile solution for various camera architectures.

Meeting market trends

Sensor Shift OIS is well position to meeting market trends towards higher mass larger format image sensors and more advanced optical zoom camera systems. A mature SMA actuator supply chain is in place that has deployed products in the market.

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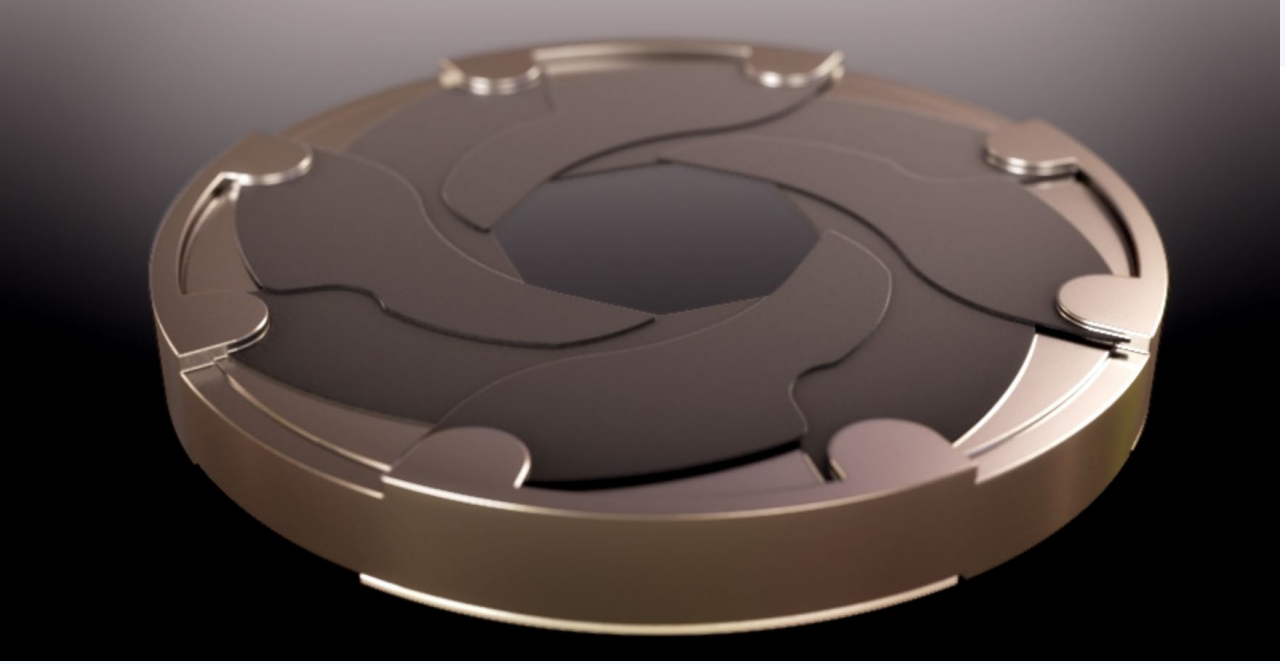

SMA VARIABLE APERTURE

Variable Aperture is an advanced feature that allows the camera to adjust the size of the lens opening (aperture) dynamically. Utilising SMA actuators, this technology is engineered for maximum versatility, particularly in main (wide-angle) cameras with larger image sensor formats. Variable Aperture enables control over depth of field, allowing more user freedom for photographic creativity.

Very low mass, low power actuator delivering depth of field and light control.

Energy Efficiency

SMA technology consumes less power, contributing to longer battery life for your device. SMA maintains aperture position with Zero Hold Power (ZHP) technology, providing high stability when the handset is in motion, without continuous power draw. This is important as SMA variable aperture does not contribute to heating of the lens elements.

No Magnetic Interference

With SMA, your camera operates flawlessly, without affecting sensitive components nearby.

Compact Design

The actuator's small footprint allows it to fit within existing smartphone profiles without extending the camera bump out. It is also significantly lighter than VCM, facilitating better AF and OIS performance.

Continuous Variable Aperture

The SMA Variable Aperture offers a continuous range of aperture sizes for advanced depth of field control.

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SMA AF

Autofocus (AF) is a crucial element in smartphone camera systems, responsible for quickly and accurately adjusting the camera lens to ensure that the subject is in sharp focus. Utilising advanced SMA actuators, our AF technology is designed to be ultra-slim and efficient, catering to various applications, including the main (wide), selfie, and ultra-wide cameras in smartphones.

Designs available for different smartphone camera slots.

Design Flexibility

CML has multiple SMA AF arrangements that can be selected for various applications. Whether you are looking for small footprint, or ultra-low z-height, our SMA AF technology allows for design flexibility for different camera arrangements, without compromising on focus quality.

Compatibility

Our AF technology is versatile enough to be used in various types of cameras. It can be readily integrated with other OIS stabilisation technologies such as variable aperture.

Lens Shift AF

The SMA Lens shift AF+OIS has been adopted as a standalone AF camera actuator. Indeed, whilst AF may be a primary camera requirement, this solution has the benefit of providing OIS in addition in a single actuator and controller IC format.

CONTACT US

ABOUT CML

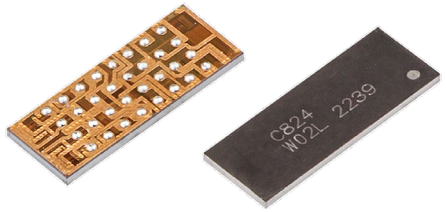
Cambridge Mechatronics Limited (CML) is a world-leading expert and developer of mechanical, optical, electrical, silicon and software designs for system-level solutions using Shape Memory Alloy (SMA) technology. Actuator solutions based on SMA wire can be controlled to sub-micron accuracy using CML's Controller ICs and control algorithms. These solutions 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 700 patents issued and pending worldwide. CML is committed to continuous development of SMA actuators, control algorithms and dedicated SMA Controller ICs 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

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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