

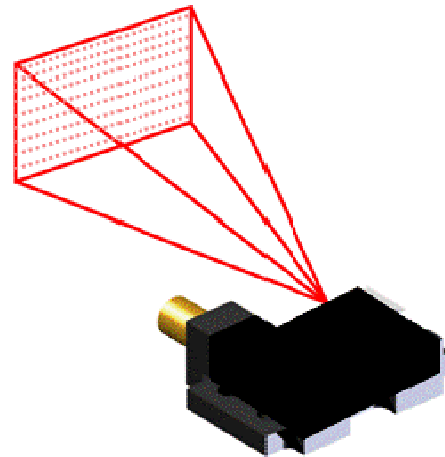
Lemoptix Laser Scanning Microprojector

Laser Scanning Microprojector

The projection system is based on a MEMS (MicroElectroMechanical-Systems) scanning micromirror that deflects a laser source in two directions and creates a regular pattern on any surface.

The image or video is stored in the projector and the image is projected pixel by pixel, line by line, re-creating the image at very high speed. The light source is pulsed at several MHz in order to project or not pixels.

Due to the use of analog scanning micromirrors, the projector size can be considerably reduced compared to existing projection solutions.



MEMS Technology

MEMS technologies are derived from the classic microelectronics industry. MEMS components are today fabricated and integrated in a large range of applications (e.g. in the automotive industry to control airbags). Excellent long-term reliability of silicon-based MEMS is one of the main reasons for adoption.

Microprojectors based on Analog Optical MEMS Scanning Micromirrors

Lemoptix's scanning micromirrors made of single-crystal silicon, show very high robustness and long-term stability. Characteristics of MEMS optical mirrors are:

- Small size
- Low power consumption
- Low operating voltage (below 3V)
- Linear mirror deflection with applied signal

The surface reflectivity is enhanced by a thin coating of metal material. The fabrication process being highly flexible, a large variety of metal materials can be coated, depending on the wavelength used.

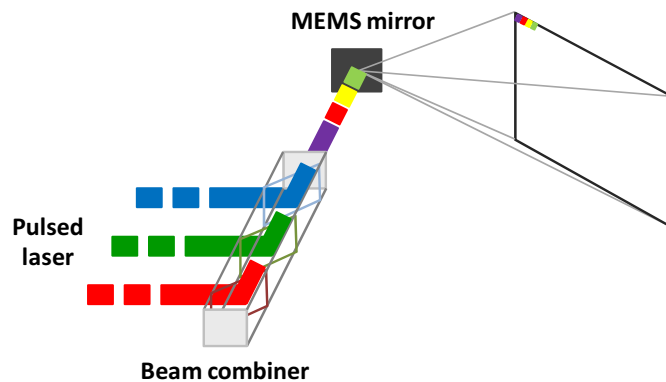


*MEMS optical scanner
(3mmx4mm) hermetically
encapsulated in glass*

Color Microprojector based on Laser Source Mixing

Monochromatic or color projectors can be built upon this technology platform.

Color projection is obtained by mixing the light source with a classical beam combiner.



Advantages of Laser Scanning Projection

Small projector thickness

The micro-projector thickness is only limited by the size of the micro-mirror (mm range) and laser source (mm range).

Small projector volume

Use of a single micromirror and laser source. No color wheel nor high power lamp required.

Ultra low-cost/high performance solution

- MEMS continuous scanning mirror instead of large matrix of MEMS digital mirrors with above-IC fabrication or LCD matrix. Low cost optimized fabrication process, massive parallel production in silicon substrate.
- No need for additional optical components compared to other projectors (*no need for illumination optics, projection lenses, UV filters, polarization conversion, X-cube prisms, trim filters*)

High brightness

Use of laser sources (suitable for outside and day-time use) as compared to LED sources. Scanning beam instead of sequential color projection (LCD) inducing 3 times more brightness for similar power consumption.

Always in focus

Image in focus from few cm to few meters due to the laser source coherence.

Large projected image

High mirror deflection providing large scanning projection angle (tens of optical degrees) without the need for optical projection lenses.

Microprojector for Consumer Applications

Due to the unique combination of performance and size, many projection applications can benefit from Lemoptix's micro-projectors:

Smartphones

View any content stored or available from the smartphone in a large form factor. Viewing and navigating through complete webpages is greatly facilitated. Sharing any content such as vacation photos or videos with friends, family and colleagues becomes easy.

For smartphone users, it is essential to be able to project even under broad daylight, on any surface flat or curved, and not have to worry about focusing the image. Without this convenience of access, the power of mobile content goes unexploited.



Digital Cameras

Today's cameras provide extremely high resolution and viewing and sharing pictures and videos on the small screen of the digital camera is inconvenient and inefficient. Viewing and sharing of taken shots will become a much better experience through microprojection in high quality on a larger area.



Laptops

As consumers and professional users of laptops are adopting smaller devices for convenience, the screen size becomes a limiting factor for comfortable viewing and sharing of images. View and share content comfortably through projection of a large, bright image with small-size laptops equipped with embedded microprojectors.



Microprojector for Information Displays

Head-up Displays

The microprojector can display important information on the windscreen, in the driver's direct field of vision.

Head-up displays in cars benefit from the key characteristics of Lemoptix projectors: high brightness, high image resolution- and "always-in-focus" capabilities (the image is sharp at any point of the window screen).



General Information Displays

The Lemoptix microprojector is suitable for any electronic equipment where human-machine interfacing is required. The embedded microprojector can then display key device information such as :

- User manual information
- Troubleshooting information

For industrial applications, real-time information projection is made possible.



Microprojector Target Performances

The first generation of micro-projectors is targeted to project a still image and moving text information. Video and TV content projection will be available in a second phase.

Characteristics	Performances
Projector thickness	< 7 mm
Optical projection engine volume	< 5 cc
Image resolution	VGA to SVGA
Image size	> 1m diagonal
Optimal projection distance	50cm to 2m
Projector brightness	> 10 lumens
Projector connectivity	VGA