



**Mirrorcle Technologies, Inc.**, located in Richmond, California, is a privately held corporation that offers products and services based on its proprietary optical microelectromechanical system (MEMS) technology. Products include the world's fastest large scan-angle two-axis scanning mirrors consisting of MEMS actuators combined with mirrors of various sizes and coatings. The ideal entry point to application and product development or research setups with Mirrorcle's MEMS mirrors is a plug-and-play Development Kit.

## FEATURES

### Mirrorcle MEMS Mirrors

- Unique and proprietary gimbal-less design.
- Ultra-low power, miniature and low cost beam steering solution.
- Fastest point-to-point dual-axis and single axis MEMS mirrors.
- Excellent repeatability and reliability.
- Large tip/tilt mechanical angles, typical range of  $\pm 6^\circ$ .
- Point-to-point (quasi-static) or resonant operation.
- Mirror diameters from 0.8mm to 7.5mm.
- Aluminum or Gold coating.
- Compact, low power MEMS drivers.

### Mirrorcle Development Kits

- Plug-and-play solution for rapid prototyping, product development, research, and education.
- It allows control of MEMS mirror, laser, and accessories from laptop, PC, or mobile devices.
- Standard Kit includes:
  - 3 MEMS Mirrors (1.2mm, 2.0mm, 3.6mm)
  - USB MEMS Controller
  - Extensive Software Suite and SDKs
  - Optical Breadboard / Laser / Mounts
  - Software Support hours
- Semi-Custom Kit: User selects all 3 mirror types, sizes, coatings, and packages.
- **Add-Ons available!** Wide-Angle Lens, Wireless Option, Laser Tracking Bundle, PSD Bundle and more.



Standard Development Kit

### Mirrorcle Software Suite



- Multiple Platforms: Mirrorcle Software supports Windows, Android (add-on), and Linux (add-on) users.
- Multiple Executable Applications enable user to prepare content for driving mirror x- and y-axis and a digital port for laser and other triggers.
- Multiple SDKs: extensive C++, Matlab, LabView, and Java (Android) Software Development Kits with examples and programming guides.

More information: <http://mirrorcletech.com/mirrorcleDraw.html>  
<http://mirrorcletech.com/devkit.html>

## FABRICATION and PACKAGING

Mirrorcle devices are fabricated in multiple MEMS fabrication facilities; assembled and tested both in-house as well as in partner facilities. Single-crystal silicon fabrication process ensures highest device repeatability, reliability, and high optical quality. Modular and flexible design and production process enables a variety of devices as well as mirror sizes optimized for a wide range of applications and requirements.

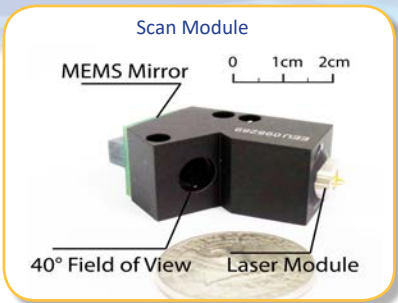


MEMS Wafer Fabrication

### Cleanroom Packaging and Testing



# SPECIFICATIONS



## Integrated Mirror Devices

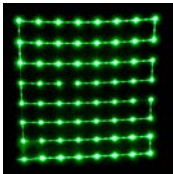
- **Mirror Sizes:** 0.8mm, 1.2mm, 1.6mm, 2.0mm, and 2.4mm diameter in stock.
- **Maximum tilt angle under point-to-point driving:**  $-6^{\circ}$  to  $+6^{\circ}$  mechanical on each axis, varies with design type.
- **Maximum tilt angle under resonant driving:**  $-7^{\circ}$  to  $+7^{\circ}$  mechanical, varies with design type.
- **24kHz, 15kHz, and 13kHz Single-axis resonant designs.**
- Visit [mirrorcletech.com/support.html](http://mirrorcletech.com/support.html) for more info.



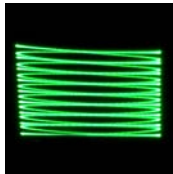
## Bonded Mirror Devices

- **Bonded Mirror Sizes:** 3.0, 3.6, 4.2, 4.6, 5.0, 6.4 and 7.5mm diameter in stock.
- **Maximum tilt angle under point-to-point driving:**  $-6^{\circ}$  to  $+6^{\circ}$  mechanical on each axis, varies with design type.
- **Maximum tilt angle under resonant driving:**  $-7^{\circ}$  to  $+7^{\circ}$  mechanical, varies with design type.
- Visit [mirrorcletech.com/support.html](http://mirrorcletech.com/support.html) for more info.

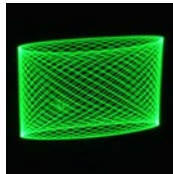
## Multiple Scanning Modes



Two-axis point-to-point (Quasi-static)



One axis resonant, other axis point-to-point



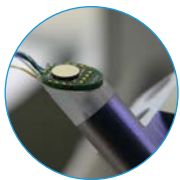
Two-axis resonant (Lissajous)

## Common Specifications for All Devices

- **Surface Roughness:**  $<10$  nm rms
- **Drive Methodology:** Electrostatic drive, using Mirrorcle's Bias-differential Quad-Channel MEMS drivers.
- **Mirror Radius of Curvature:**  $>5$  m
- **Mirror Coating:** Aluminum or Gold
- **Positional repeatability:** Better than  $0.001^{\circ}$  (1 millidegree)
- **Operating temperature:**  $-40^{\circ}\text{C}$  to  $125^{\circ}\text{C}$
- **Optical Window:** Anti-reflection coated fused silica windows. Removable. Visit [mirrorcletech.com/support.html](http://mirrorcletech.com/support.html) for more info.
- **Optical power handling:** Up to 2W any mirror, any wavelength. Above 2W depends on mirror sizes, wavelength. E.g. 3W CW blue or green on a 2mm or larger mirror.
- **First resonant rotation frequency:**  $>3$  kHz for both axes for small mirror sizes,  $>1.2$ kHz for 2.0mm size, etc.

# AREAS of APPLICATION

## Biomedical Imaging



OCT / Microscopy

Range-finding and Targeting

## Telecommunications



LiDAR



Dynamic Solid State Lighting

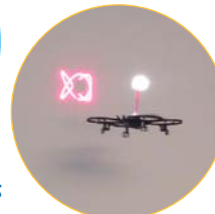
## Entertainment



Projection Displays

3D Scanning and Laser Imaging

## AR / VR



Wearable Displays



3D Tracking and Position Measurement

Q-Switch

Free Space Communications