MIRRORCLE PLAYZER TECHNOLOGY
PRODUCT OVERVIEW

MIRRORCLE TECHNOLOGIES, INC.

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Please contact us for additional product details, custom device specifications, and large-quantity quotations
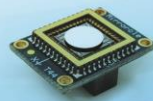
Introduction to the Technology

Mirrorcle's **Vector Graphics Laser Projection (VGLP) Architecture** combines a full technology stack of software, electronics, and optical laser beam-steering solutions to enable fully programmable and re-configurable laser projection and display of bright, high-contrast graphic content on a variety of surfaces.

The architecture optimizes the performance of lasers and fast **gimbal-less dual-axis MEMS mirrors** to achieve highest "wall-plug power to visibility" efficiency. A critical feature of the architecture is to utilize lasers of modest optical power at very high duty cycles and to deliver all available illumination to the desired vector graphics and image, and not to spread it over a wide area as in typical pico-projectors or DLP displays.

Playzer is a pocket-sized programmable vector graphic laser projector which consists of a MEMS Mirror-based **Scan Module** with an **embedded Controller**. Playzer is controlled by **Software Applications** and a **Software API** (by default Windows and optionally Linux or Android-based). It is a compact solution for displaying graphics in a multitude of environments, both outdoor and indoor.
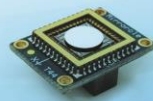
Picoprojector (32 lm)

DLP Projector (100 lm)

VGLP Projector (6 lm)

An indoor, full light comparison of various projector technologies, projecting onto a wall 2m away, shows superior performance of the VGLP while using less power.

Brief Overview and History of Mirrorcle Display Solutions

- **2005-2006** Windshield Display for Continental/BMW

    - High brightness and contrast achieved via vector graphics and laser-phosphor technology

    - Display directly on the Windshield / Glass, very wide angle (100° x 100°)

- **2007-Present** Full video (picoprojector) technology established in addition to vector display technology for different applications
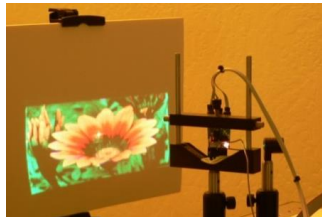

- **2012** Mirrorcle Software Suite – Android is added with wireless functionality for smartphones

- **2013-2015** Miniaturization of Optical Cell results in production-ready Scan Modules

- **2015** Mirrorcle presents award-winning laser-phosphor based HUD technology

- **2016** Playzer is born, a pocket-sized projector unit with compact Controller

- **2018** Key supplier in Dynamic Laser Light Program for automotive applications

- **2019** 4th Generation Monochrome Scan Module production started at CM in Asia

- **2019** RGB Playzer prototype is introduced at SPIE Photonics West 2019

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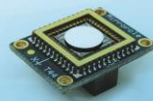
Playzer for Robotics

Industrial production, transportation, and service industries are going through a revolutionary transformation. A key role in that transformation belongs to robots and drones. **Massive deployment of autonomous mobile robots and drones** brings many advantages including space optimization, process optimization, speed, efficiency improvement, and flexibility in handling changes in operations in service and delivery. At the same time, the deployment of these smart machines creates a new working dynamic where **interaction between humans and robots is frequently required**. Challenges are plenty, and a major factor in this interaction is a **need for a constant safety improvement**.

Conditions in industrial facilities and warehouses are notoriously loud and noisy, which significantly hinders sound-based interactions between humans and robots/drones. This indicates a need for efficient visual messaging interaction. However, most warehouse and factory environments also employ bright lights which precludes existing technologies such as LEDs for use in these conditions. **Playzer offers a solution through the VGLP architecture**, providing **high contrast visual messaging** for applications in robotics.

Playzer offers multiple visual messaging solutions for robotics:
High contrast **signage**, **text**, **graphics**, and **safety indications**
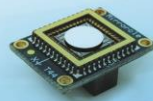
Monochrome PLAYZER Development Kit: PZDK-04x OEM

PZDK-04x OEM **P**la**y**zer **D**evelopment **K**it ("**x**" is either **R**, **G**, **B**, or **V** representing laser wavelength) is a demonstration and development bundle using Mirrorcle's **V**ector **G**raphics **L**aser **P**rojection (**VGLP**) technology consisting of a **Playzer Module**, Windows **Software Applications**, and **Software Development Kits** in C++, Matlab, and LabView. **Playzer Module PZ-04(R/G/B/V) OEM** has a **fast dual-axis quasi-static MEMS mirror,** giving **several kHz of vector graphics bandwidth**. The Kit allows a plug-and-play, simple and playful environment for testing and developing laser projection applications. The module includes a single-color laser source with a choice of following colors/wavelengths: (**R**) for 638nm red, (**G**) for 520nm green, (**B**) for 450nm blue, (**V**) for 405nm violet.
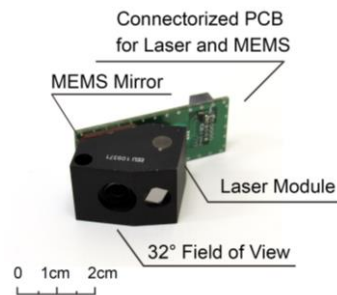
This development kit is intended for development and prototyping purposes as an **OEM** subsystem for incorporation into customer's prototypes and end products. Therefore, it does not comply with the appropriate requirements of FDA 21 CFR, section 1040.10 and 1040.11 for complete laser products.

Targeted Applications: Industrial and Robotics Laser Projection, HUD, Digital Signage, Entertainment.

Dev Kit Includes: Monochrome Playzer Module, full Mirrorcle Software Suite with SDKs, optical mount, support hours.

Scan Module in PZ-04

High contrast, outdoor, user-programmable graphics

VGLP Design and Manufacturing Assistance Tool
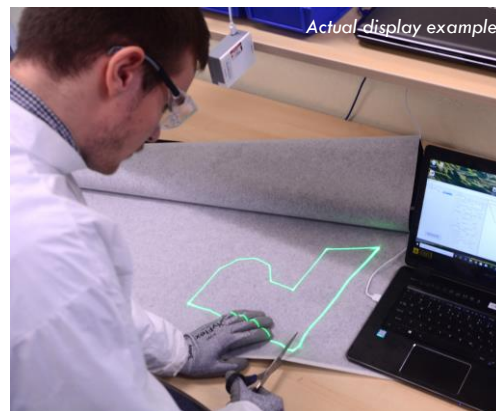
Features and Specifications:

- ☐ VGLP, display vector content at >=40Hz refresh rate
- ☐ R/G/B/ or V laser, 8-12mW, 8-bit Digital Modulation
- ☐ Analog brightness control of a single laser
- ☐ Approx. 32° x 32° Field of View
- ☐ <0.01° Beam position repeatability
- ☐ MEMS Mirror: A7M10.2-1000AL
- ☐ USB Interfaced and Powered
- ☐ <1000mW Power Consumption

VGLP and 3D Perception Sensing Solutions for Robotics
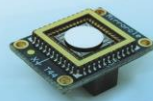
RGB PLAYZER Development Kit: PZDK-03RGB OEM

PZDK-03RGB OEM or **P**layzer **D**evelopment **K**it is a demonstration and development bundle using Mirrorcle's **V**ector **G**raphics **L**aser **P**rojection (**VGLP**) technology consisting of an **RGB Playzer Module**, Windows **Software Applications**, and **Software Development Kits** in C++, Matlab, and LabView. **Playzer Module PZ-03RGB OEM** has a **fast dual-axis quasi-static MEMS mirror,** giving **several kHz of graphics bandwidth**. The Kit allows a plug-and-play, simple and playful environment for testing of displaying and other programmable laser applications. The module includes three laser sources(R|G|B), each with 8-bit digital modulation, that are combined in free-space.

This development kit is intended for development and prototyping purposes as an **OEM** subsystem for incorporation into customer's prototypes and end products. Therefore, it does not comply with the appropriate requirements of FDA 21 CFR, section 1040.10 and 1040.11 for complete laser products.

Targeted Applications: Industrial and Robotics Laser Projection, HUD, Digital Signage, Entertainment.

Dev Kit Includes: RGB Playzer Module, full Mirrorcle Software Suite with SDKs, support hours.

PZDK-03RGB OEM

Robot-human interaction: safety, warning messaging
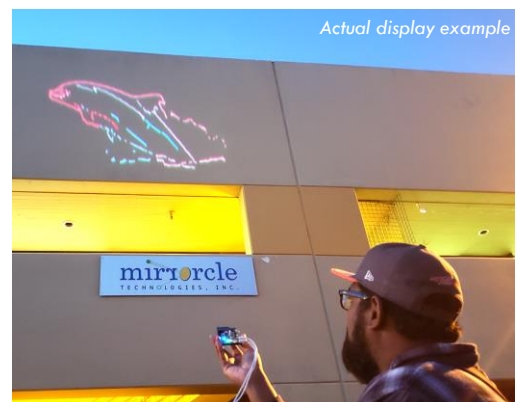
Features and Specifications:

- ☐ VGLP, display vector content at >=40Hz refresh rate
- ☐ Combined RGB Laser, 8-12mW, 8-bit Digital Modulation
- ☐ Analog brightness control of R, G, and B lasers
- ☐ Approx. 32° x 32° Field of View
- ☐ <0.01° Beam position repeatability
- ☐ MEMS Mirror: A7M10.2-1000AL
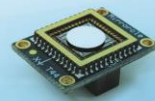- ☐ USB Interfaced and Powered
- ☐ <1500mW Power Consumption

Actual display example

High contrast, visible outdoor and indoor projection

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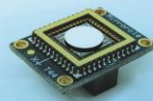
Mirrorcle Software Suite – Applications

mirrorcle*Draw*

The software suite enables users to perform MEMS mirror device driving from proof of concept in new application development to products. Additionally, it has been proven to be an excellent educational tool for MEMS students and professionals. There are multiple Windows-based executables which give users control of all of the mirrors' various modes of operation - point-to-point (quasi-static) beam steering, line-by-line uniform velocity rastering, vector graphics at various refresh rates, bitmap image laser displaying or laser marking, one-axis-resonating, and Lissajous patterns.
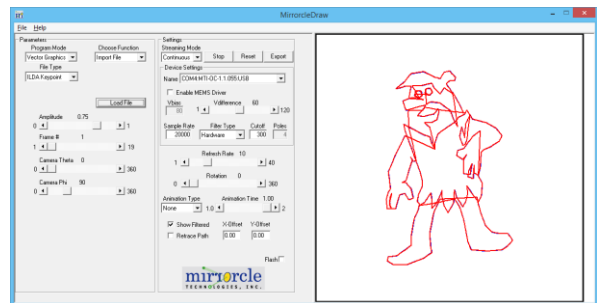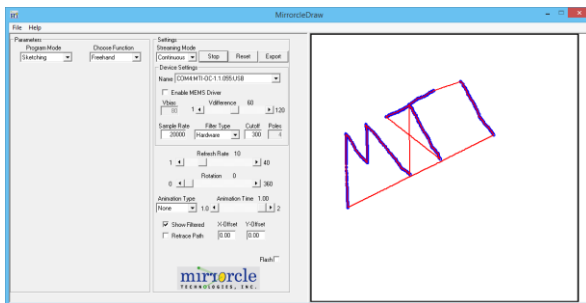
Mirrorcle Software Suite – Applications includes:

☐ **MirrorcleDraw** – a powerful Windows application with an extensive Graphical User Interface (GUI). It enables users to prepare content for driving MEMS mirror's x-axis, y-axis, and a digital port (e.g. for laser modulation, camera triggering), and to run that content on USB MEMS Controllers. Content generation includes vector graphics modes, raster modes, function generating modes, quasi-static positioning mode (point-to-point movement), Lissajous pattern modes, ILDA file import capability, keypoint and sample text file import and export capability, etc.

☐ **MTIDevice-Demo** – the compiled C++ SDK example project file which demonstrates a variety of ways to drive MEMS mirrors in point to point, scanning, rastering, and other modes.

☐ **MirrorcleLinearRaster** – a command prompt based application that controls the two axes (tip and tilt) of a MEMS mirror in a laser beam steering system to deflect the laser beam in a line by line raster patter optimal for laser marking, bio-medical imaging and similar applications.

☐ **MirrorcleListDevices** - a small tool to scan the ports for MTI devices. It will report any Mirrorcle MEMS Controllers available for connection whether by USB connection or wireless (Bluetooth) and their respective COM ports.

☐ Software Support Hours (obtain formal quotation for details)

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Mirrorcle Software Suite – SDKs

Mirrorcle offers comprehensive, open Application Programming Interfaces (APIs) for generation of content (MEMS/beam positions and beam brightness) and control and streaming of content. Where hardware permits, Mirrorcle's API supports controlling correlated digital outputs, reading of analog inputs, synchronization with additional Controllers or peripherals, tracking, etc.

The complete Mirrorcle Software Suite, as **included in a Playzer Development Kit**, includes **SDKs** in three languages:

- **C++**
- **LabVIEW**
- **Matlab**

These SDKs include the libraries needed to build your own application as well as well-documented source code examples to get you started.

Additionally, extensive online documentation and API references are provided at https://mirrorcletech.com/documentation/

More information about software and platform options including Android and Linux-compatible suites available at https://www.mirrorcletech.com/wp/products/software/
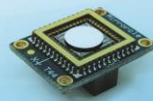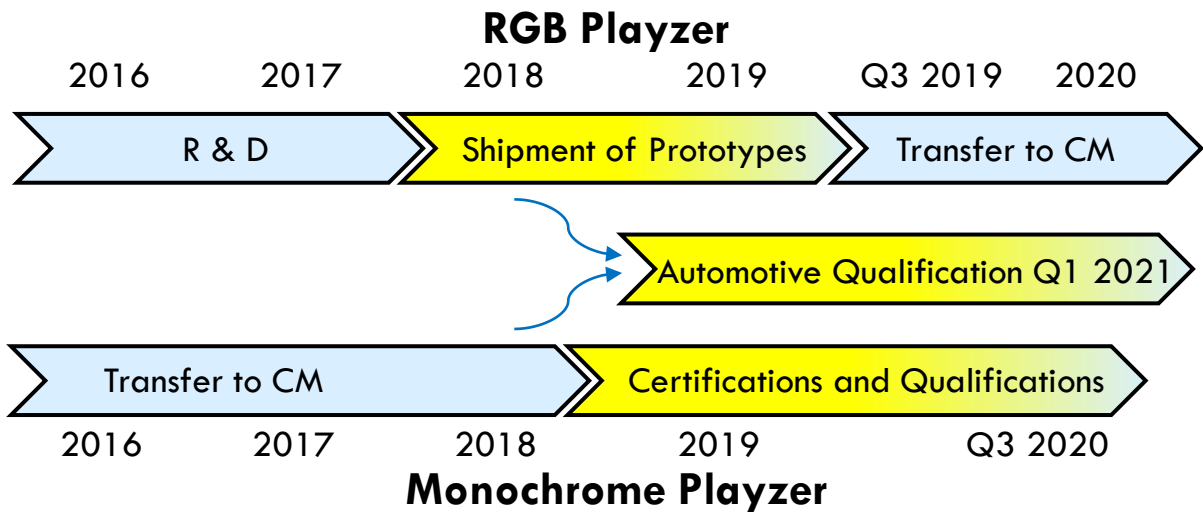
Future of VGLP Displays

CERTIFICATIONS AND QUALIFICATIONS

❑ Certifications and qualifications are planned in safety, EMC, and automotive categories.

❑ Mirrorcle is working with multiple foundries on different continents on the path towards automotive qualification.

RGB PLAYZER PRODUCTION

❑ For initial prototypes, Mirrorcle has been partnering with vendors for RGB laser modules and assembling final Playzer Modules in-house.

❑ Mirrorcle is contracting pilot manufacturing runs of RGB Playzer modules at qualified CMs.

❑ Low volume production and qualifications will follow.

RGB Playzer

2016	2017	2018	2019	Q3 2019	2020

R & D	Shipment of Prototypes	Transfer to CM

Automotive Qualification Q1 2021

Transfer to CM	Certifications and Qualifications

2016	2017	2018	2019	Q3 2020

Monochrome Playzer

Planned Qualifications:

☐ ISO26262 ASIL B(D), IEC 60825-1

☐ RoHS, REACH

☐ CISPR 25

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