Overview

- Mirrorcle Technologies MEMS mirrors are available in the following standard ceramic-based packages:
  - **Recommended**, Connectorized Form (PCB with LCC): TINY20.4, TINY48.4
  - Un-connectorized Form: DIP24

- In special cases of larger quantity orders, other packages may be considered after initial NRE and successful development.

- MEMS Mirror actuator **die sizes and matching packages** are provided here, with the recommended package in **bold**.
  - Options matching 4.25mm x 4.25mm actuators – **TINY20.4**, TINY48.4, DIP24
  - Options matching 5.20mm x 5.20mm actuators – **TINY20.4**, TINY48.4, DIP24
  - Options matching 7.25mm x 7.25mm actuators – **TINY48.4**, DIP24
Definitions

Axes, Typical Orientation in Optical Setup, Rotation Directions and Terminal Labels
Orientation of Axes – TINY20 and TINY48

- X+ and Y+ mirror rotation are defined by the rule of (right-hand) thumb, based on the x and y axes as shown in each diagram. (more on next page)
- Typically, MirrorcleTech MEMS mirrors are mounted so that X Axis driving provides laser beam sweep in the horizontal plane.

[Diagram showing orientation of axes and pin connections]

- S##### Device ID (serial number)
- ^UP^ Designation on backside of PCB
- X+ rotation
- Y+ rotation
- Y Axis
- X Axis
- Pin 1
Mirrorcle documentation defines scanning based on rotation **about** an axis. For example, rotation about the X axis is shown in images below (LEFT), which when mounted in Mirrorcle’s standard mounts results in horizontal scanning.

**Rotation about the X Axis**, as governed by X+ and X- terminals on the device results in beam scanning in the YZ plane (when laser is incident also in YZ plane).

X+ terminals are used to generate torque for positive (X+) rotation about the X Axis, X- for opposite.

**Rotation about the Y Axis**, as governed by Y- and Y+ terminals on the device results in beam scanning in the XZ plane (when laser is incident in XZ plane).

Y+ terminals are used to generate torque for positive (Y+) rotation about the Y Axis, Y- for opposite.

Note: Refer to Application Note **AN004 - Angle of Incidence** for additional information on the incoming beam orientation.
X+ and Y+ mirror rotation is defined by the rule of (right-hand) thumb, based on the x and y axes as shown in each diagram.

Typically, MirrorcleTech MEMS mirrors are mounted so that X Axis driving provides laser beam sweep in the horizontal plane.
Connectorized Packages Overview

Packages:

TINY20.4
TINY48.4

Mounts:

MOUNT-TINY.4-KMS
MOUNT-TINY.4-NM
TINY20.4

All units in mm

4X Ø 1.73

15
12

15
12

1.65
1.57
5.6

Pin 1

View from front

Pin 1

View from back

10-Pin connector (see page 11)

S##### Device ID (serial number)
TINY48.4

All units in mm

S######## Device ID  
(serial number)

10-Pin connector  
(see page 11)
# Bill of Materials

<table>
<thead>
<tr>
<th>Item #</th>
<th>Qty</th>
<th>Ref Des</th>
<th>Digikey Part No.</th>
<th>Description</th>
<th>Package</th>
<th>Type</th>
<th>SMTs</th>
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<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>J1</td>
<td>1175-1629-ND</td>
<td>IDC BOX HEADER 0.050 10 POS</td>
<td>10-pin conn</td>
<td>smt</td>
<td>1</td>
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<tr>
<td>2</td>
<td>1</td>
<td>MEMS Package</td>
<td>LCC Package</td>
<td>LCC20, LCC48</td>
<td>LCC</td>
<td>smt</td>
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# J1 Connector Pinout

## 10 - Pin Header – J1

<table>
<thead>
<tr>
<th>Pin</th>
<th>Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>HV_A (X+)</td>
<td>MEMS Channel X+</td>
</tr>
<tr>
<td>2</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>3</td>
<td>HV_B (X-)</td>
<td>MEMS Channel X-</td>
</tr>
<tr>
<td>4</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>5</td>
<td>HV_C (Y-)</td>
<td>MEMS Channel Y-</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>HV_D (Y+)</td>
<td>MEMS Channel Y+</td>
</tr>
<tr>
<td>8</td>
<td>GND</td>
<td>Ground</td>
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<tr>
<td>9</td>
<td>N/C</td>
<td>No Connection</td>
</tr>
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<td>10</td>
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<td>Ground</td>
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</table>

## Connector Part No.

<table>
<thead>
<tr>
<th>Connector Part No.</th>
<th>Pins</th>
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</tr>
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<tbody>
<tr>
<td>Digikey ID: 1175-1629-ND</td>
<td>10</td>
<td>Cable: SAM8219-ND</td>
</tr>
</tbody>
</table>
Using Connectorized Package MEMS Mirrors

- **Option 1: User’s own setup**
  - TINY20.4 and TINY48.4 packages can be used as delivered without any Mirrorcle-provided mounts (directly connected to Controller or Driver via ribbon cable). Users can utilize one or more of the provided holes or other methods to mount in their optical setups. Electrical connection from the Package connector is made directly to a Mirrorcle MEMS Controller or Driver.
  - P/N: n/a

- **Option 2: Mechanical Kinematic Mount for Breadboarding**
  - TINY20.4 and TINY48.4 packages can be mounted on a Mirrorcle-designed machined aluminum mount using 0-80 screws. The mount is assembled on top of a Thorlabs KMS mount with a ½” diameter post for easy integration into optical breadboarding setups. Electrical connection from the Package connector is made directly to a Mirrorcle MEMS Controller or Driver.
  - P/N: MOUNT-TINY.4-KMS
The mechanical mount has threaded holes for mounting onto a kinematic optical mount (KMS) with a breadboarding posts (8-32 thread), and holes for mounting of TINYPCBs (0-80 thread).

Carefully place the MEMS Mirror Package onto the mechanical mount such that the connector sits into the cavity, allowing for the cable to be connected from behind.

Secure the Package with two diagonally placed 0-80 screws.

Note: This Mount is not necessary in the optical setup. It is only intended as an optomechanical mount to assist with breadboarding and may be omitted. Mechanical model of mount available for purchase.

Note: No KMS P/N is MOUNT-TINY.4-NM
Unconnectorized Packages Overview

Packages:
DIP24

Mounts:
MOUNT-DIP.5-KMS
DIP24 Dimensions

Ceramic Dimensions: 30.5 mm x 15.1 mm
Ceramic Thickness: 2.16 mm
Pin Pitch: 2.54 mm
MOUNT-DIP.5-KMS Definitions

PCB Dimensions: 66.04mm x 25.40mm x 1.57mm
ZIF Socket Height: ~12.5mm
*ZIF socket lock extends 14mm from edge of PCB

Easiest Handling:
Device in DIP24 can be handled with gloved hands.
Socket operation does not require a tool.
DIP24 MiniPCB Circuit Schematic
# Bill of Materials

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<td>1</td>
<td>CON1</td>
<td>1175-1628-ND</td>
<td>BOX HEADER, 0.050 10 POS</td>
<td>Header</td>
<td>thru-hole</td>
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<tr>
<td>2</td>
<td>1</td>
<td>CON2</td>
<td>A300-ND</td>
<td>24 PIN ZIF SOCKET</td>
<td>Socket</td>
<td>thru-hole</td>
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## CON1: Connector Pinout

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</tbody>
</table>
For the DIP24 MEMS Mount, pin 1 is shown in the photos below, and pin 13 matches with the ZIF socket’s lever (socket is used opposite a “standard” ZIF configuration).

On the MEMS mirror’s DIP24 package, a gold marker indicates pin #1. Take care not to touch the protective cover covering the device. See figures in the following page for more details.

Prior to inserting the device into the ZIF socket, raise the lever on the ZIF socket to the up position. Carefully insert the DIP24 into the ZIF socket, mating pin 1 locations, and gently lower the ZIF lever to the down position (CAUTION: do not allow the lever to snap down!).

Note: When handling devices, disable the MEMS driver or Controller, or unplug the MEMS output cable from the MEMS driver or Controller.
How to Use – 2

- Always wear clean lab gloves and observe electrostatic discharge (ESD) protection procedures when handling devices. Open the lever on the ZIF socket such that it is 90° from the PCB surface.

- Hold the package only on its sides, not in any areas near the device cavity and the device itself. Place it into the ZIF socket.

- While holding the package against the MEMS Mount, (to prevent it from falling out when the ZIF lever is released), slowly lock the package into the socket by moving the lever on the ZIF package to the close position using two fingers.
MEMS Mirror Part Number Generation
MEMS Device Part Number Generation

Format: \text{ACTUATOR-MIRROR-PACKAGE-COVER}

AAAA.A-BBBBCC-DDDD-EE/F/GG

- A: MEMS actuator Design ID (e.g.: A7M20.2)
- B: Mirror diameter in microns (e.g.: 2000, NM for no Mirror)
- C: Mirror coating (AL, AU, SI for uncoated Silicon)
- D: MEMS carrier package ID (e.g.: TINY20.4)
- E: Cover window coating selection (see “Package Cover” section)
- F: Window mounting option option: (see “Package Cover” section)
- G: Cover attachment method (see “Package Cover” section)
Package Cover
Cover Windows

- Five standard window options (four with double-sided AR coated and one with no AR coating):

<table>
<thead>
<tr>
<th>Window Coating</th>
<th>Coating Range [Min]</th>
<th>Coating Range [Max]</th>
<th>AOI [°]</th>
<th>Transmittance [%]</th>
<th>P/N</th>
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<tbody>
<tr>
<td>Type A</td>
<td>400 nm</td>
<td>675 nm</td>
<td>22.5°</td>
<td>&gt;98%</td>
<td>A</td>
</tr>
<tr>
<td>Type B</td>
<td>675 nm</td>
<td>1040 nm</td>
<td>22.5°</td>
<td>&gt;98%</td>
<td>B</td>
</tr>
<tr>
<td>Type C</td>
<td>1040 nm</td>
<td>1600 nm</td>
<td>22.5°</td>
<td>&gt;98%</td>
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</tr>
<tr>
<td>Type AB</td>
<td>400 nm</td>
<td>980 nm</td>
<td>22.5°</td>
<td>&gt;96%</td>
<td>AB</td>
</tr>
<tr>
<td>No coating</td>
<td>400 nm</td>
<td>2000 nm</td>
<td>22.5°</td>
<td>&gt;88%</td>
<td>NC</td>
</tr>
</tbody>
</table>

- All window types transmittance are specified for +/-5° from AOI (Angle of Incidence) of 22.5°, however, performance is not highly dependent on AOI.

- Customer specific wavelengths and AOI can be arranged for orders in quantities from 500 units.
The selected window is typically mounted flat on the package, over the rim of the ceramic carrier.

In P/N section F use: F

Example P/N with Flat-mounted window: A7M20.1-2000AL-TINY20.4-A/F/EP
Window Mounting - Wedged Window

- The AR-coated window can be mounted on an anodized aluminum wedge with a tilt to avoid reflections from the window to appear within (near the center of) the MEMS field-of-regard.

- The standard wedge is designed with a -11° tilt about the MEMS Y Axis (negative rotation about the Y Axis, sending the residual reflection up)

- In P/N section F use: W

Examples of Devices with Cover Windows

Wedge-Mounted Windows

Flat-Mounted Windows
Package Cover Attachment Options

There are 3 methods of attaching the cover to the package:

- Cover is permanently attached to the package using adhesive.
  - In P/N section G use: EP

- Cover is attached to the package using double-sided tape on all 4 sides.
  - In P/N section G use: TP

- Cover is lightly attached to the package using double-sided tape on 2 sides.
  - In P/N section G use: 2TP

- As an exception to the naming system, for customers who request temporary windows for shipping protection only, the cover section of the part number simply states “TW”. Any window (uncoated or coated, no specified optical performance) is lightly attached (double-sided tape on only 2 edges) for protection of the MEMS Mirror and for easier removal.
Thank You for Choosing

If you have any further questions or suggestions please email us:

support@mirrorcletech.com