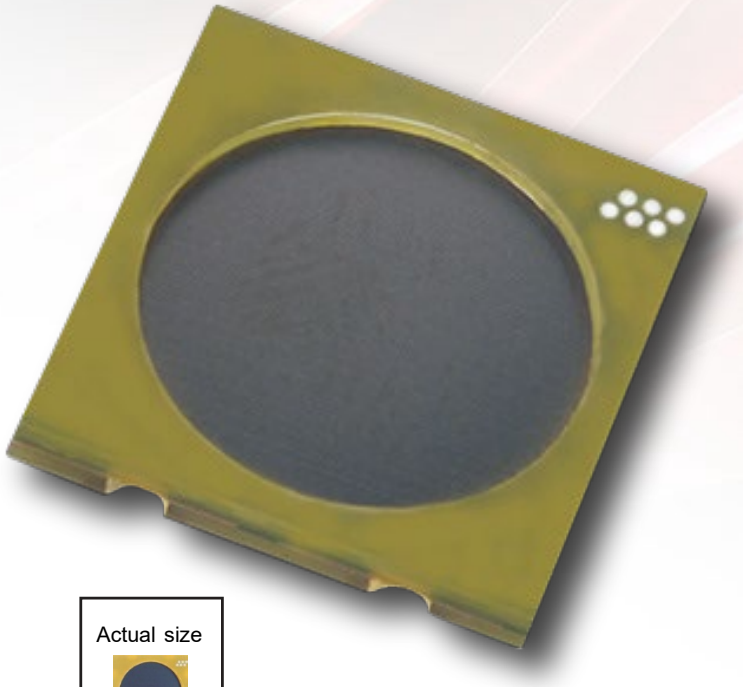
INTERLINK ELECTRONICS

INTEGRATION GUIDE



MicroNav™

INTEGRATION GUIDE | Version 4.0

Enabling Micro-Navigation for Macro Applications

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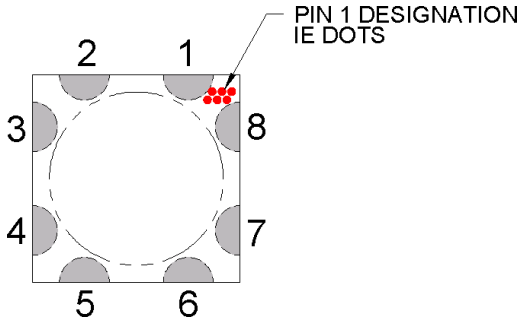
1.0 General Description

MicroNav is a 360° mouse pointing sensor based on Interlink Electronics' patented Force Sensing Resistor (FSR) technology. FSR sensors are sensitive to compressive forces applied to the sensor's surface and are optimized for use in human touch controlof electronic devices. MicroNav is solder re-flow compatible for automated assembly and requires only one resistor and one ADC for integration. MicroNav offers ultimate flexibility in actuator integration in a small footprint device (10mm x 10mm x 1.3mm) - ideal for integration into cell phones, PDAs and other handheld computing solutions. MicroNav provides intuitive & easily integrated 360-degree navigation with pressure-based control of acceleration.

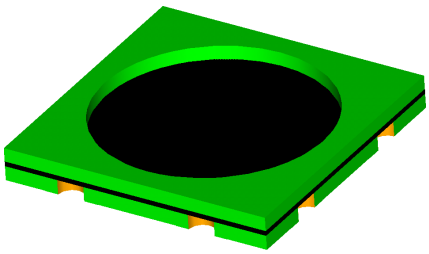
Features

- Continuous 360° direction control through the touch of a finger or thumb
- No moving parts to break, wear out or gum up, ensuring a robust, reliable, maintenance-free control solution
- Pick and Place compatible
- Solder re-flow compatible
- Only 1 ADC and 1 resistor needed
- Ultimate design flexibility of actuator
- Compatible with your existing keypad membrane

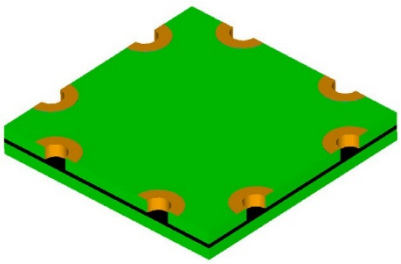
Connection Diagram



Pin Number	Description
1	Common
2	North
3	West
4	Common
5	Common
6	South
7	East
8	Common



Top view



Bottom view

2.0 Package Diagram

2.1 Physical Dimensions

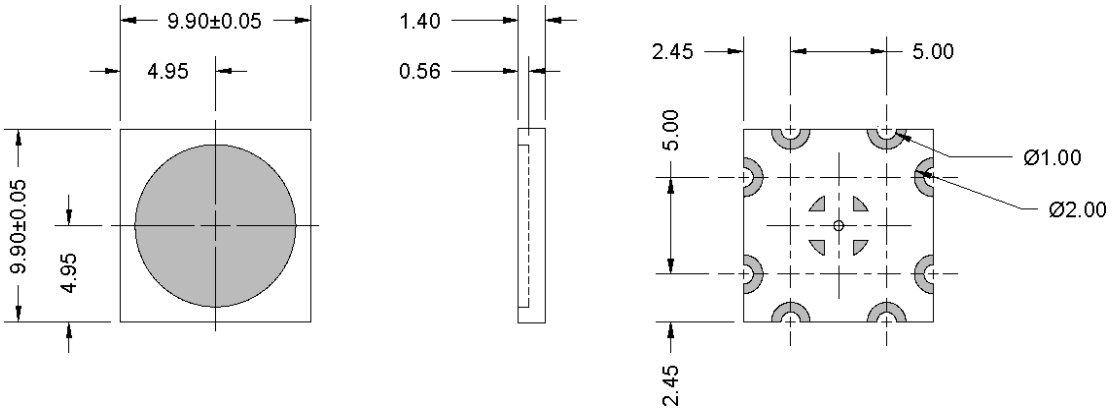


Figure 2.1

2.2 Recommended PCB Footprint

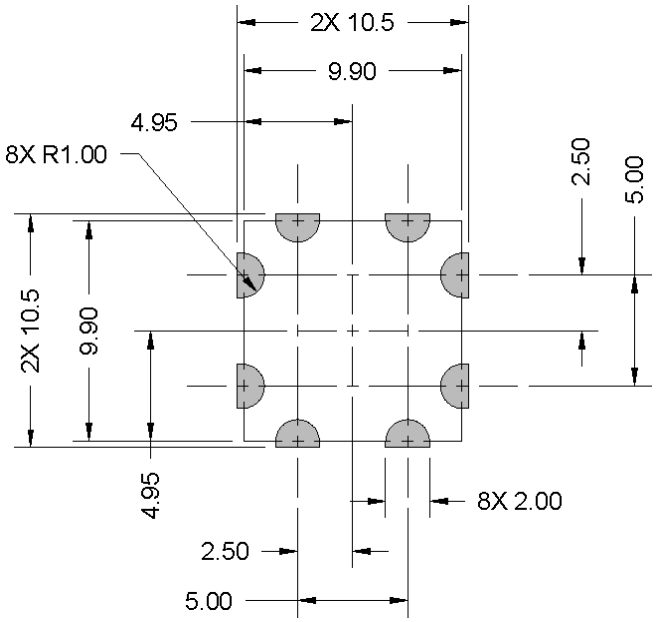


Figure 2.2

2.3 Soldering Instructions

- Compatible with lead free solder reflow. Maximum temperature 260°C.
- Not compatible with 'wash'.

3.0 Reference Design

3.1 Equivalent Schematic

MicroNav is a four-zone sensor with each (north, south, east, and west) of the interpenetratingzones covering half of the active area. Measuring resistance between each zone and the common trace gives a resistance that is inversely proportional to applied force.

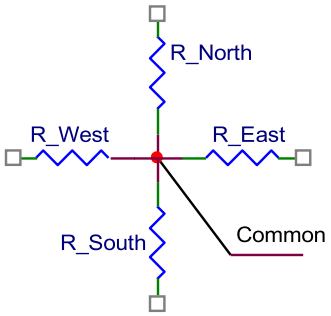


Figure 3.1

3.2 Circuit Reference Design

Each zone of the MicroNav is connected to an I/O pin of a microcontroller, with the common pin into an ADC. As each zone is zone driven, its internal resistance forms a voltage divider with R_o.The ADC reading of each zone is then directly proportional to the force applied to that zone.

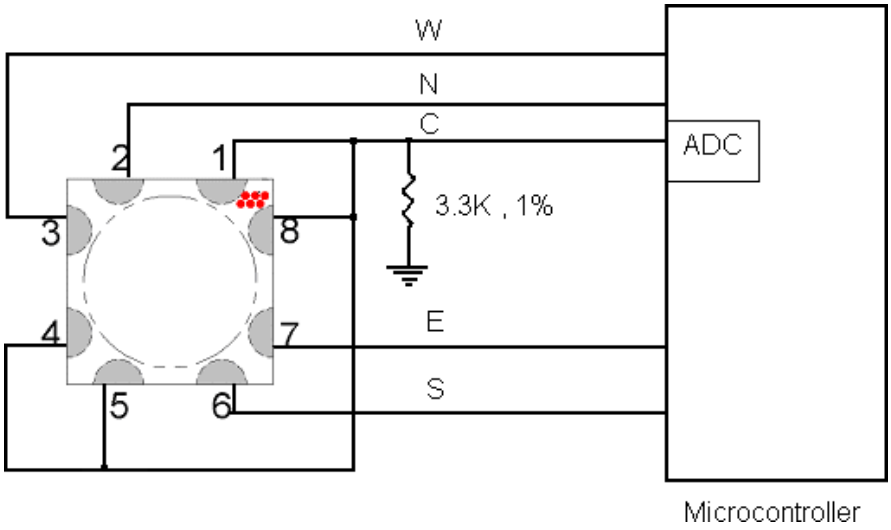


Figure 3.2

3.3 Device Characteristics

- Resistance is inversely proportional to force ($R \approx \frac{1}{F}$)
- Resistance of each zone varies from $\approx$40KΩ at first touch to $\approx$4KΩ at high force
- Details of the force curve depend on actuator mechanics

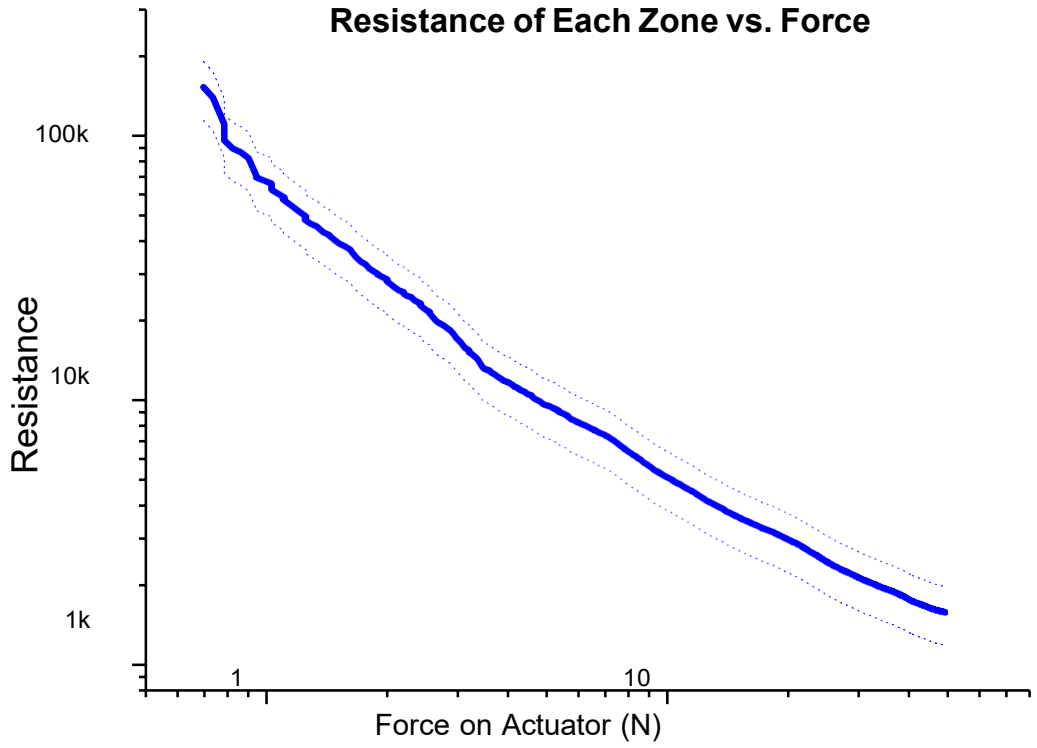


Figure3.3

3.4 Actuator Reference Design

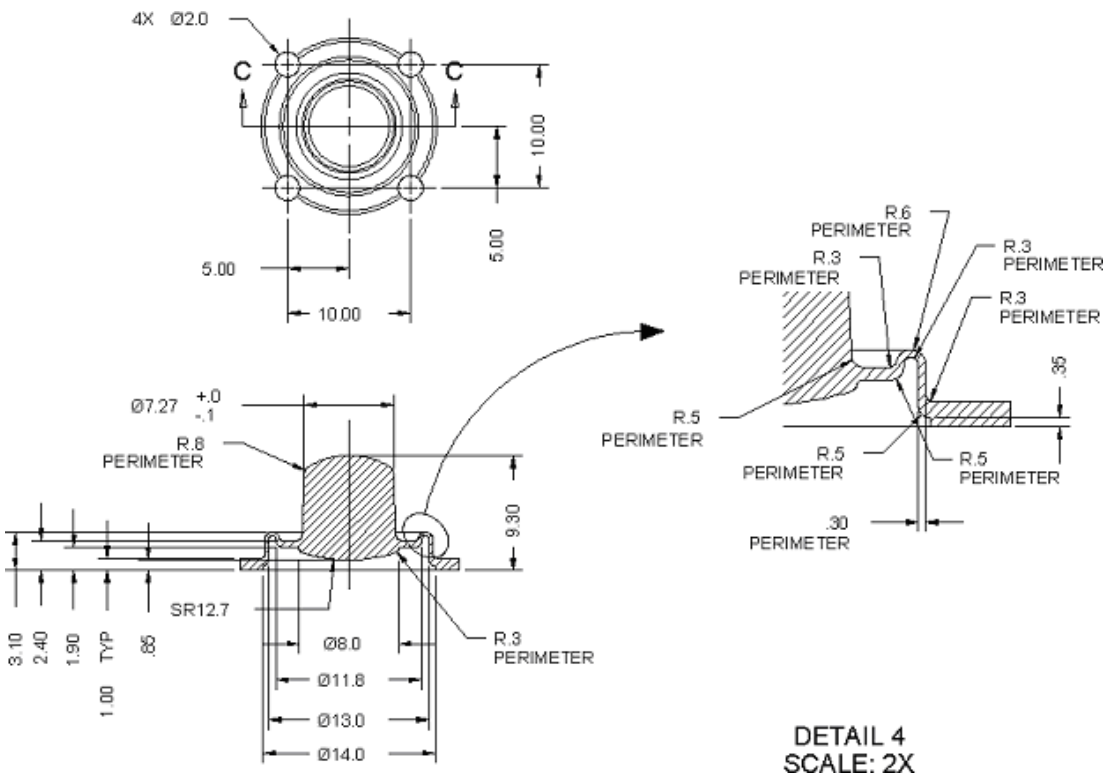


Figure 3.4

To obtain a 3D CAD file please contact your Interlink Electronics Technical Support Team.

4.0 Performance Specification

4.1 Durability

MicroNav successfully passed the following tests:

- **Flat Tap Test:** 2,000,000 taps at 1,000 grams

  Purpose

  To test the ability of the MicroNav sensor to withstand long-term use in situations where the host PCB is well constrained against flexing and where actuation force is applied vertically downward.

  Method

  The sensor was soldered to a 1.6mm thick FR4 circuit board and placed on a flat, hard surface. A reference design actuator was placed over the sensor and the center of the sensor was tapped 2,000,000 times at a rate of 4 taps per second with a force of 1kg +/-25 grams (See Figure 3.4).

- **Angled Tap Test:** 2,000,000 taps at 1,000 grams

  Purpose

  To test the ability of the MicroNav sensor to withstand long-term use in situations where the host PCB is well constrained against flexing and where the actuation occurs at angles inclined 15° from vertical.

  Method

  Same as Flat Tap method but the flat surface is inclined 15° from vertical.

- **Flexing Tap Test:** 2,000,000 taps at 1,000 grams

  Purpose

  To test the ability of the MicroNav sensor to withstand long-term use in situations where the host PCB may flex.

  Method

  Same test parameters as for the Flat Tap method but here the board is supported at its two ends such that the board was flexing between the supports.

- **Shoulder Tap Test:** 2,000,000 taps at 1,000 grams

  Purpose

  To test the ability of the sensor housing, rather than the active part of the sensor, to withstand repeated actuation. This actuation could arise in the case of actuator misalignment or in the case of poor actuator design. This is unlikely in cases of proper design.

  Method

  Same test parameters as for Flat Tap method but here the circuit board is adhered to a hard flat surface. The shoulder of the sensor was struck rather than the sensor active area.

- **Continuous Normal Load Test:** 5,000 grams for 24-hour duration

  Purpose

  To test the ability of the sensor to withstand and recover from a continuous vertical load.

  Method

  The sensor is depressed straight down with a force of 5Kg for 24 hours applied through areference design actuator such as specified in the Engineering Specification. The tap tester applied pressure to the sensor through the actuator.

- **Continuous Angled Load Test:** 5,000 grams for 24-hour duration

  Purpose

  To test the ability of the sensor to withstand and recover from continuous load applied at an angle from vertical.

  Method

  The same test parameters as for the Continuous Normal load test except that the sensor was depressed at an angle of 15° from vertical.

- **Altitude Test:** 30,000 feet altitude (9,000 meters)

  Method

  Expose sensors to altitude conditions provided by the bell jar and compressor unit to verify the storage specification of 10,000 feet (3,000 meters) for a 4-hour time duration.The samples were functional after the test.

- **Drop Test:** 5 feet (1.53 meters) drop, 6 orientations

  Purpose

  Verify that the sensors can withstand the shock of being dropped onto a tiled floor, such that the drop causes the actuator to be struck at semi-random angles. Drop height was 5 feet (1.53 meters), with one drop per each side.

  Method

  Sensors were soldered onto a special test PCBA mounted onto a case. A special IR receiver was used to verify performance.

- **Board Torsion Test:** Twist PCBA to +/-15°

  Purpose

  To test the ability of sensors to withstand forces applied by twisting the host PCB.

  Method

  A sensor was soldered to a 1.6mm thick FR4 circuit board. The board was clamped at one end. The opposite end of the PCB was twisted 15°, held for 60 seconds, twisted 15° in the opposite direction then released.

- **Thermal Shock Test:** -20^{0}C for 1 hour, 70^{0}C/ambient RH for 65 minutes transition to each extreme – repeated 10 times

- **Mechanical Shock:** 80g for 11ms 1/2sine shock pulses in 6 primary axes. 18 shocks per orientation (Refer to Mil std 202)

- **Mechanical Vibration:** NAVMAT P9492A

- **Solvent:** Solvent cleaning with alcohol PCB cleaner

- **Re-flow:** 10x at 260°C: Force curve of resistance of all 4 zones in parallel vs. force using a reference design actuator changed less than 10% when measured at room temperature.

4.2 Temperature

- Operating Temperature Range: -20 °C to +55 °C
- Storage Temperature Range: -35 °C to +85 °C

4.3 Additional Features

- A seamless water-and dust-proof interface can be designed to meet NEMA 4, 4X, 6 and/or12 standards (IP65, IP66, IP67).
- Stand-Off Resistance: >1MΩ
- EMI/ESD: Passive device

5.0 Application Notes

MicroNav provides 360° cursor-pointing capabilities. Using Interlink Electronics' patented Force Sensing Resistor (FSR) technology, MicroNav offers smooth pressure-controlled cursor acceleration and a complete set of actuator reference designs to enable Internet, e-mail, gaming, and menu functions for handheld devices.

MicroNav is available in 3 configurations: (1) ***Sensor Only*** with firmware for the most popular microprocessors provided in the form of object code libraries; (2) ***Sensor with Microprocessor***available in serial, PS/2 and USB interfaces and (3) ***Sensor on PCB*** with microprocessor and rubber actuator for small to medium size footprints where a drop-in cursor control solution is required.

6.0 Packaging

Units will be shipped in tape and reel packaging. MicroNav Sensors are currently packaged 5000 pieces per reel on 24mm tapes. (See below)

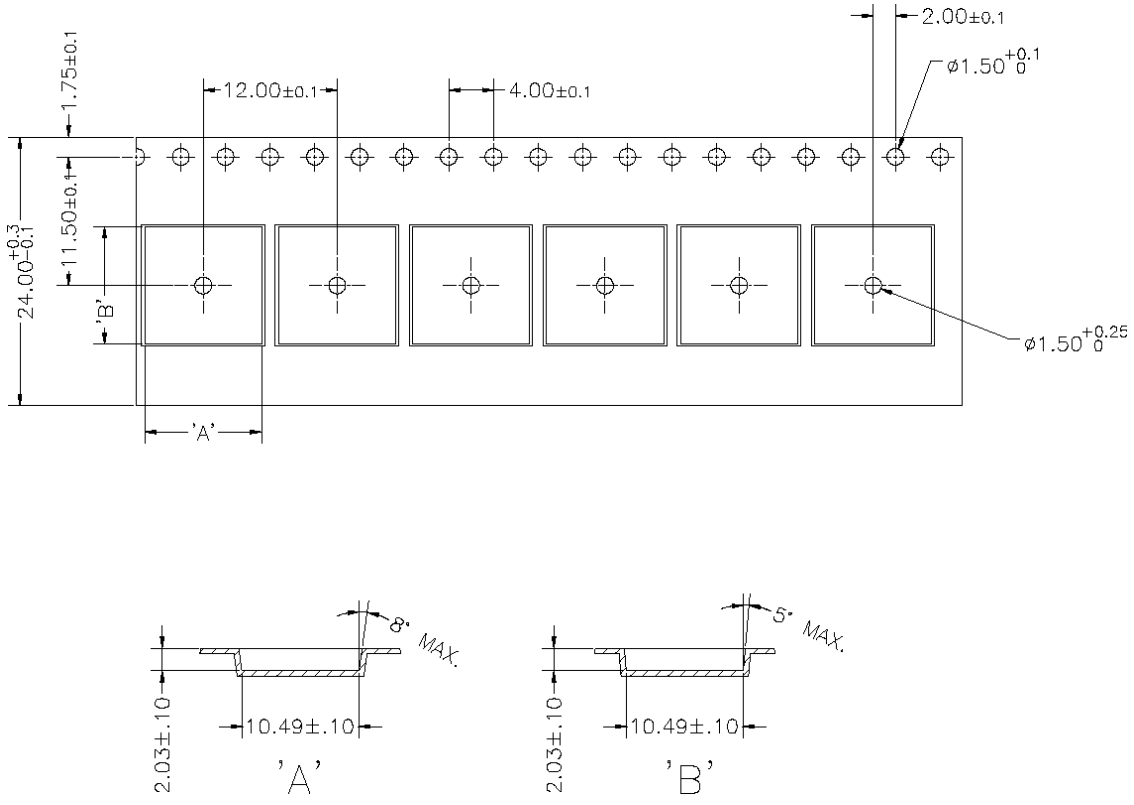


Figure 6.1

7.0 Intellectual Property & Other Legal Matters

Interlink Electronics holds several domestic and international patents for its Force Sensing Resistor technology. FSR and Force Sensing Resistor are company trademarks. All other trademarks are the property of their respective owners.

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8.0 Contact Interlink Electronics

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