FLEXIBLE FORCE SENSOR 374-12

DATASHEET AND APPLICATION NOTES

APPLICATIONS

Measuring contact pressures between wearable devices and the human body, soft touch buttons, pressure sensing, touch panels, contactless sliders, rotational encoder, force/grip measuring, proximity detection

ADVANTAGES

Robust thin and flexible connection between sensor and a signal processing device

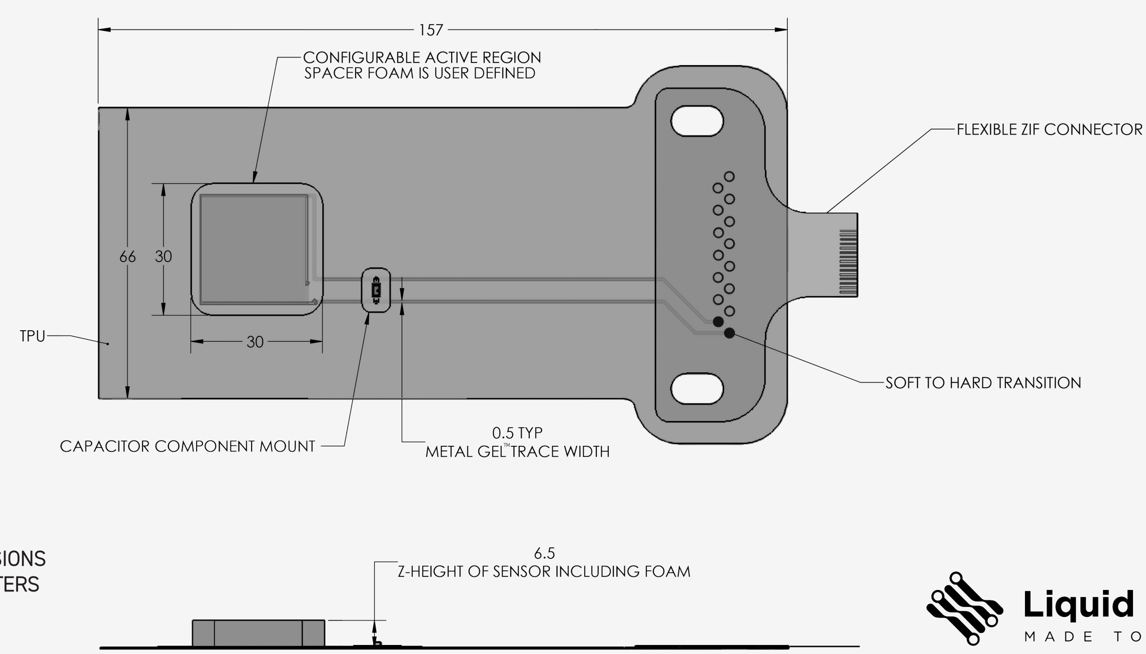
KEY FEATURES

Customizable for a wide range of load detection and active surface area, bonding capabilities across all fabric types—knits, wovens and non-wovens, manufacturable across complex shapes and curvatures

FORCE SENSOR SPECIFICATIONS	
Force range	2.5 N – 150 N
SNR (worst case)	134 at 2.5 N
Durability (# of actuations)	Tested up to 30,000 cycles
Hysteresis	Foam dependent
Linearity (1 defines ideal)	.98
Contact surface material	Fabric/foam
Target inductance	10 nH
Temperature sensitivity	0.1%/°C
Operating temp range	-15° C to 50° C
Sensing area	Customizable
Connector	Flexible polyimide ZIF

PRINCIPLE OF OPERATION

The force sensor page consists of an inductor made up of two turns of Metal Gel™ paired with a known capacitor and a metal plate separated from the inductor by a block of foam.



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PRINCIPLE OF OPERATION CONT.

An IC measures the change in inductance as the metal plate is pressed closer to the inductor and lights up the LEDs in response to the logarithmic change in inductance. Based upon calibration or known parameter values (foam spring rate, LC tank formed by inductor and capacitor), the applied force or pressure can be computed.

The resonant frequency of an LC tank formed by the parallel combination of a known capacitor and the sensing coil is used to measure the inductance of the coil. Resonance is achieved by injecting a time varying AC signal into the coil. This causes the coil to generate a time varying electromagnetic (EM) field around the coil. The EM field around the coil will induce eddy currents in a metal plate brought in proximity to the coil. This results in a decrease in the measured inductance of the coil, computed from the new resonant frequency.

$$f_{resonance} = \frac{1}{2 * \pi * \sqrt{L * C}}$$

$$L = \frac{1}{4\pi^2 * f_{resonance}{}^2 C}$$

Force, or pressure, is measured by placing a foam block with known spring rate between the coil and metal plate.

$$f_{spring} = -k * x$$

Given the spring rate of the foam and reference measurements of the inductance change of the coil versus distance between the coil and metal plate, the applied force can be calculated. With the assumption that the force is applied over the sensor contact area, the force per unit area or pressure can be computed.

This same effect can be used to detect proximity (to a metallic object) or with multiple sensing channels, linear or rotational movement of a metallic or magnetic object based on the orientation of the sensing coils and object being tracked.

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