

Cost Considerations for Embedding FlexiForce™ Sensors into a Device Design

Exploring Both the Direct and Indirect
Cost Savings of Selecting FlexiForce
Touch Sensor Technology for Your
Force-Sensitive Application

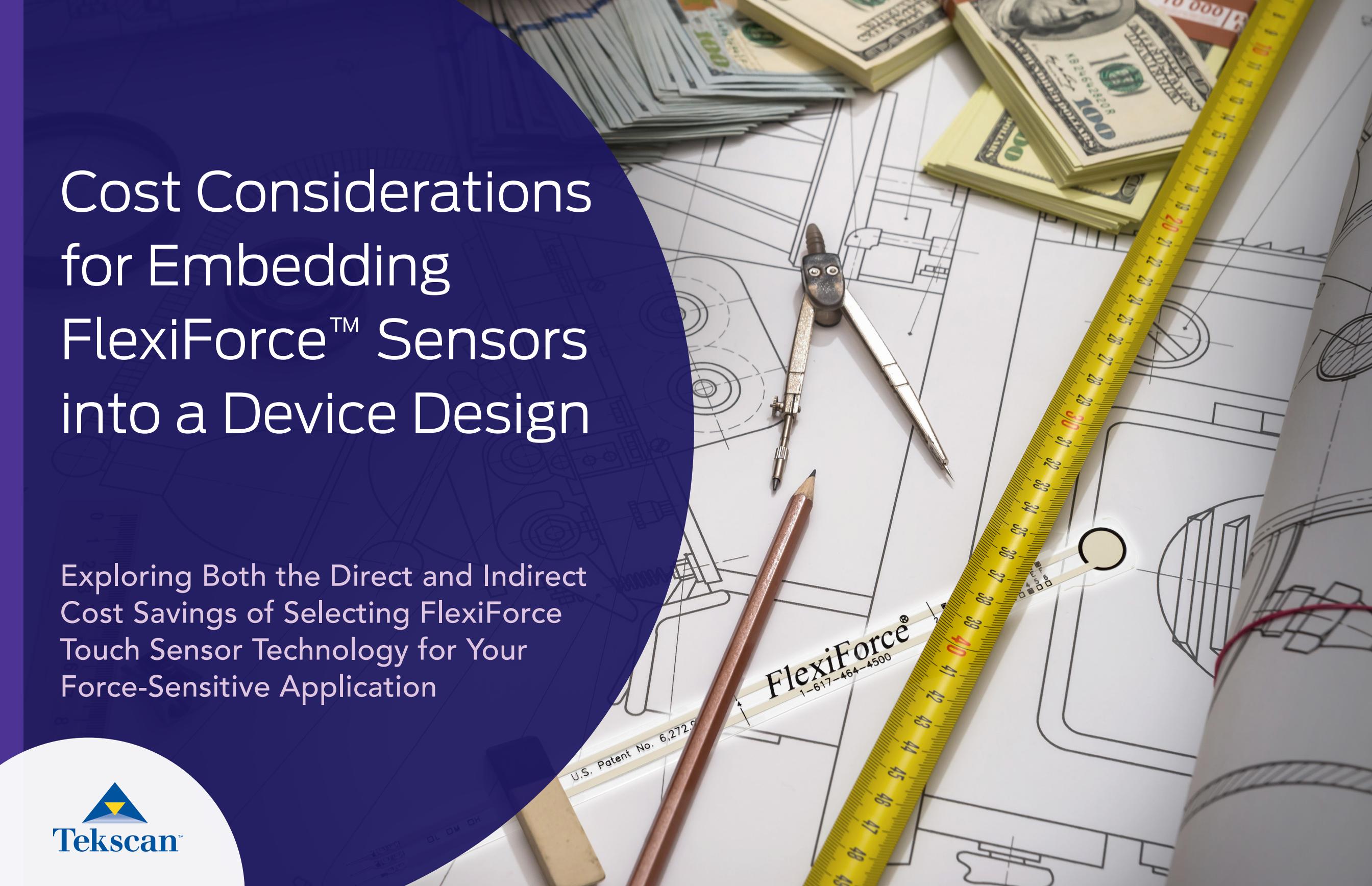


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INTRODUCTION

Save On Every Part of the Technology Investment

There are three key qualities that all great design engineers share: the ability to design to spec, within budget, and within deadline.

However, as technology continues to evolve, maintaining these responsibilities becomes increasingly difficult.

While many design engineers could happily spend their days experimenting with different sensor technology options within a device design, the companies and stakeholders they represent demand results.

As an ultra-thin, low power force-sensing technology, Tekscan's line of FlexiForce™ touch sensors provide several benefits to design engineers seeking easy-to-integrate force-sensing capabilities in their device. However, the mechanical and electrical properties of FlexiForce touch sensors are not the only reasons this technology has been successful in so many embedded applications.

Tekscan helps design engineers minimize expenses in a variety of ways, including:

- Access to wide range off-the-shelf sensors in small, affordable quantities
- Support of application engineers who are experts in the technology
- Access to an extensive library of free mechanical and electrical integration resources, and more!

This paper explores how FlexiForce touch sensors help design engineers design to spec, budget, and deadline, with specific emphasis on the budget aspect. Whether FlexiForce sensors are the right choice for your application, or ultimately you determine another technology is better suited for your needs, the information provided here will shed light on what to look for from any force sensor provider you choose.



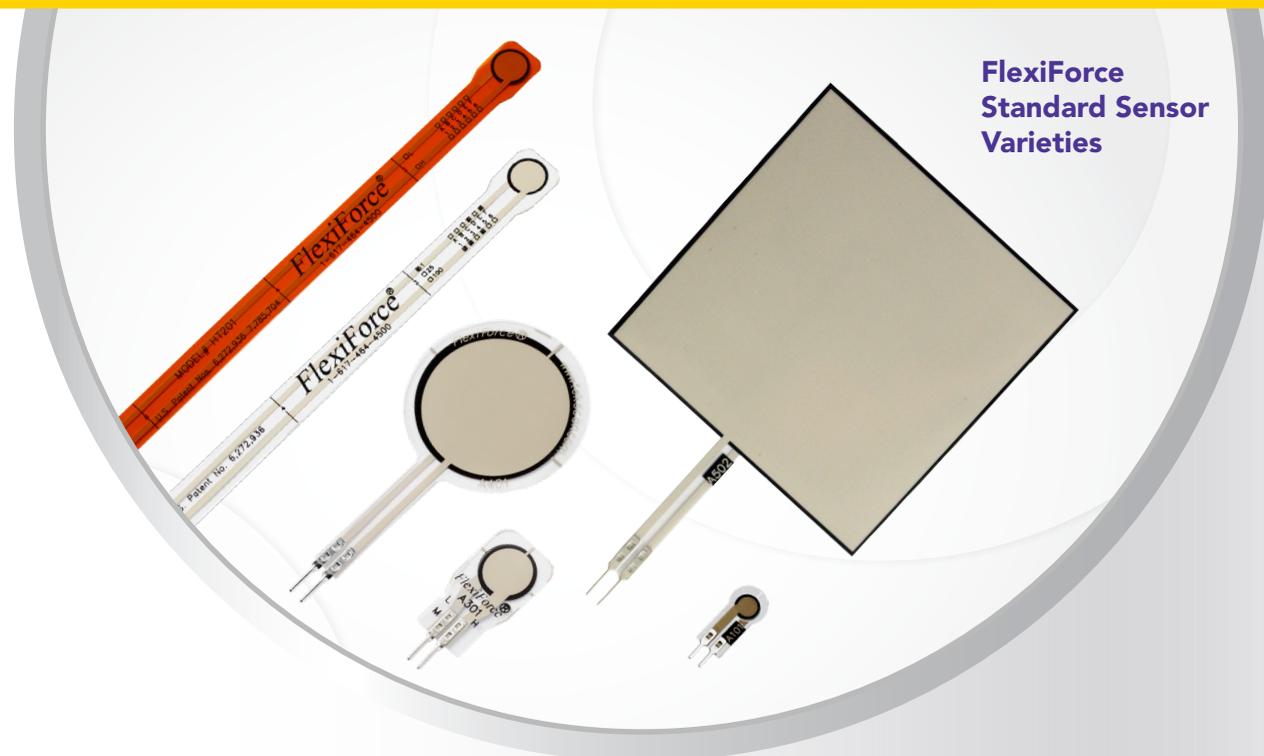
Low Cost Evaluation

As you begin investigating force sensor providers, take note of any low-cost, low-commitment evaluation options that may be available to you. The ability to experiment with the technology, without having to make a significant up-front investment, can help you narrow your focus while keeping cost efficient.

HOW TEKSCAN HELPS YOU SAVE: Several Off-the-Shelf Sensor Designs Available in Low Quantities

If you have not browsed our online store, Tekscan offers a wide range of off-the-shelf sensors in different sizes, force ranges, and operational capabilities. Most of our customers start here during their prototyping/proof-of-concept design stage.

- To keep costs manageable, these sensors are made available in four- and eight-packs
- Sensors available in high-temperature (up to 200°C (400°F)) formats, and also Enhanced Stability (ESS) formats for high-humidity operating conditions
- All sensors can also be trimmed to whatever size or shape your application requires ([visit this link for a brief introduction on trimming FlexiForce touch sensors](#))

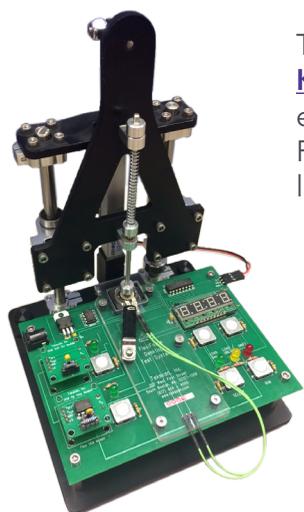


FlexiForce Standard Sensor Varieties

Tools that Make Integration Easy

Once you have your off-the-shelf sensors, consider investing in our FlexiForce OEM Development Products

FlexiForce Sensor Characterization Kit



The FlexiForce Sensor Characterization Kit is a time-saving, affordable tool enabling engineers and designers to understand how FlexiForce sensors perform in a controlled loading environment.

- Apply controlled loading profiles, change circuit modules, and calibrate sensors in this all-in-one kit
- Save time creating fixtures and circuitry

FlexiForce Prototyping Kit

The FlexiForce Prototyping Kit allows you to efficiently progress your FlexiForce-embedded design through advanced integration phases.



- Plug in your preferred circuit module(s), easily adjust sensitivity, and gain confidence in FlexiForce sensors



[Click Here to Shop Off-the-Shelf Sensors & Kits](#)

MECHANICAL INTEGRATION CONSIDERATIONS

The direct cost of the sensor is just one factor in the overall technology investment. There are also costs associated with the time and effort it takes to fully integrate a force sensor within the mechanical constraints of the device's design. Taking note of certain physical properties required for the design will help you stay on track.

HOW TEKSCAN HELPS YOU SAVE: Sensors that Conform to Your Needs

The obvious appeal of FlexiForce touch sensors is the ability to design around tight space constraints. While other force-sensitive components like load cells may require more space in a design, the thin, minimally-invasive construction of FlexiForce sensors help design engineers implement force-sensing capabilities and avoid design revisions.

There are several other mechanical benefits to FlexiForce touch sensors, including:

- Various methods to connect the sensor, which can help reduce costs. [Click this link to view these options in greater detail](#)
- Simple methods to evenly distribute a force load (aka: load concentrators or pucks) can help design engineers compensate for force contacts that are larger or smaller than the sensor's sensing area
- Other useful resources – [including the Best Practices for Mechanical Integration Guide](#) – offer important considerations to keep design engineers on the path to success



**FlexiForce A201
Standard Sensor**

KEY MECHANICAL CONSIDERATIONS

- 1 A load concentrator (aka, a shim or puck) ensures even loading and repeatable, accurate output
- 2 Minimize shear force to preserve sensor sensitivity
- 3 Avoid mounting sensors with hard-setting adhesives or epoxies, since this can disrupt transmission of force

**DOWNLOAD THE FREE GUIDE FOR
MORE DETAILS**



ELECTRICAL INTEGRATION CONSIDERATIONS

Power efficiency is always an important competitive differentiator for electronic devices. Naturally, introducing sensing technology into a design will ultimately impact how the device consumes power – whether plugged in, or battery operated.

HOW TEKSCAN HELPS YOU SAVE: Keep Your Circuitry Simple

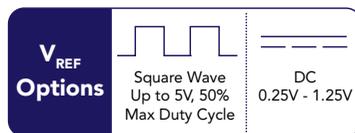
FlexiForce touch sensors are passive elements that act as a force-sensing resistor in an electric circuit. Unlike load cells or strain gauges, FlexiForce touch sensors can function on simple, inexpensive electronics. Take note that an inverting op-amp circuit (dual source) is the recommended circuit for powering FlexiForce touch sensors.

There are certain electrical integration benefits of FlexiForce touch sensors that may help you save in design time efforts and expense, including:

- Superior linearity (<±3% of full scale) and repeatability (<±2.5%) compared to similar force-sensitive resistor technology
- A large dynamic range of resistance allows for the design engineer to use electronics that do not require filtering
- Depending on the application, the sensor's sensitivity can be adjusted by changing drive voltage and resistance of the feedback resistor to get more range out of your sensor choice. [Click this link for more information](#)
- Easier to design devices with in-field calibration capabilities

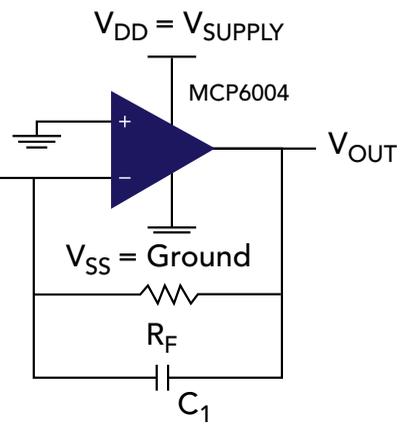
Recommended Circuit: Inverting Op-Amp (Dual Source)

$$V_{OUT} = -V_{REF} * (R_F / R_S)$$



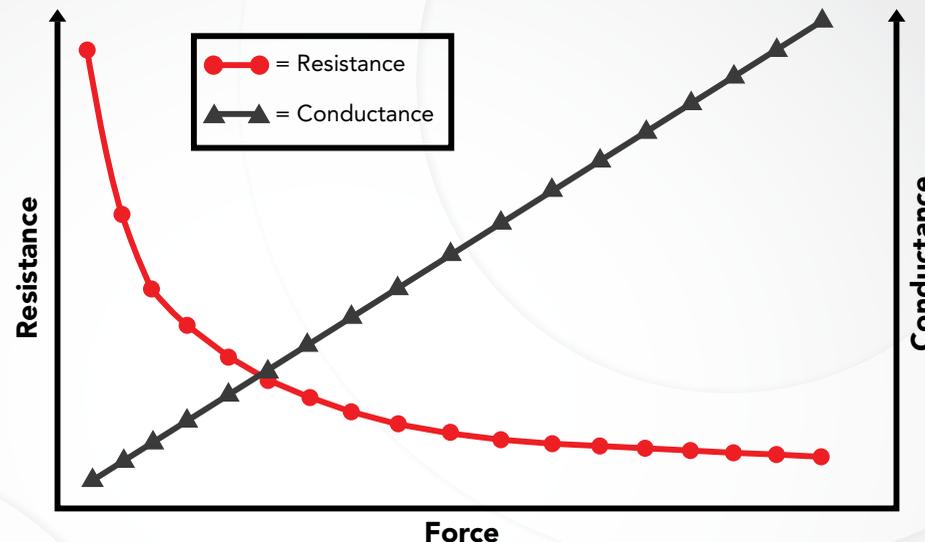
$R_{FEEDBACK} (R_F) = 100k\Omega$
POTENTIOMETER

$C_1 = 47 \text{ pF}$



100K potentiometer and 47 pF are general recommendations; your specific sensor may be best suited with a different potentiometer and capacitor. Testing should be performed to determine this.

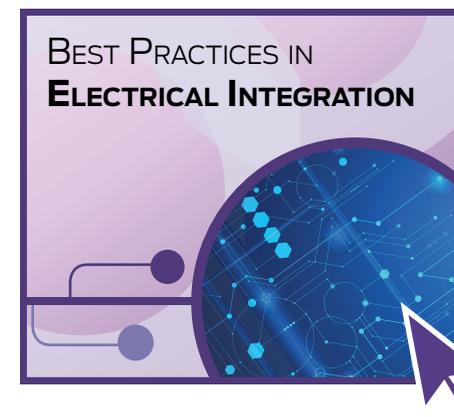
- Polarity of V_{REF} must be opposite the polarity of V_{SUPPLY}
- Sensor Resistance R_S at no load is typically $>1M\Omega$
- Max recommended current is 2.5mA



With greater applied force, the sensor's resistance decreases and generates a linear conductance signal.

Need other circuit options, sensitivity adjustment, and calibration tips?

DOWNLOAD THE FREE GUIDE FOR MORE DETAILS



CLEAR, CONCISE CUSTOMIZATION

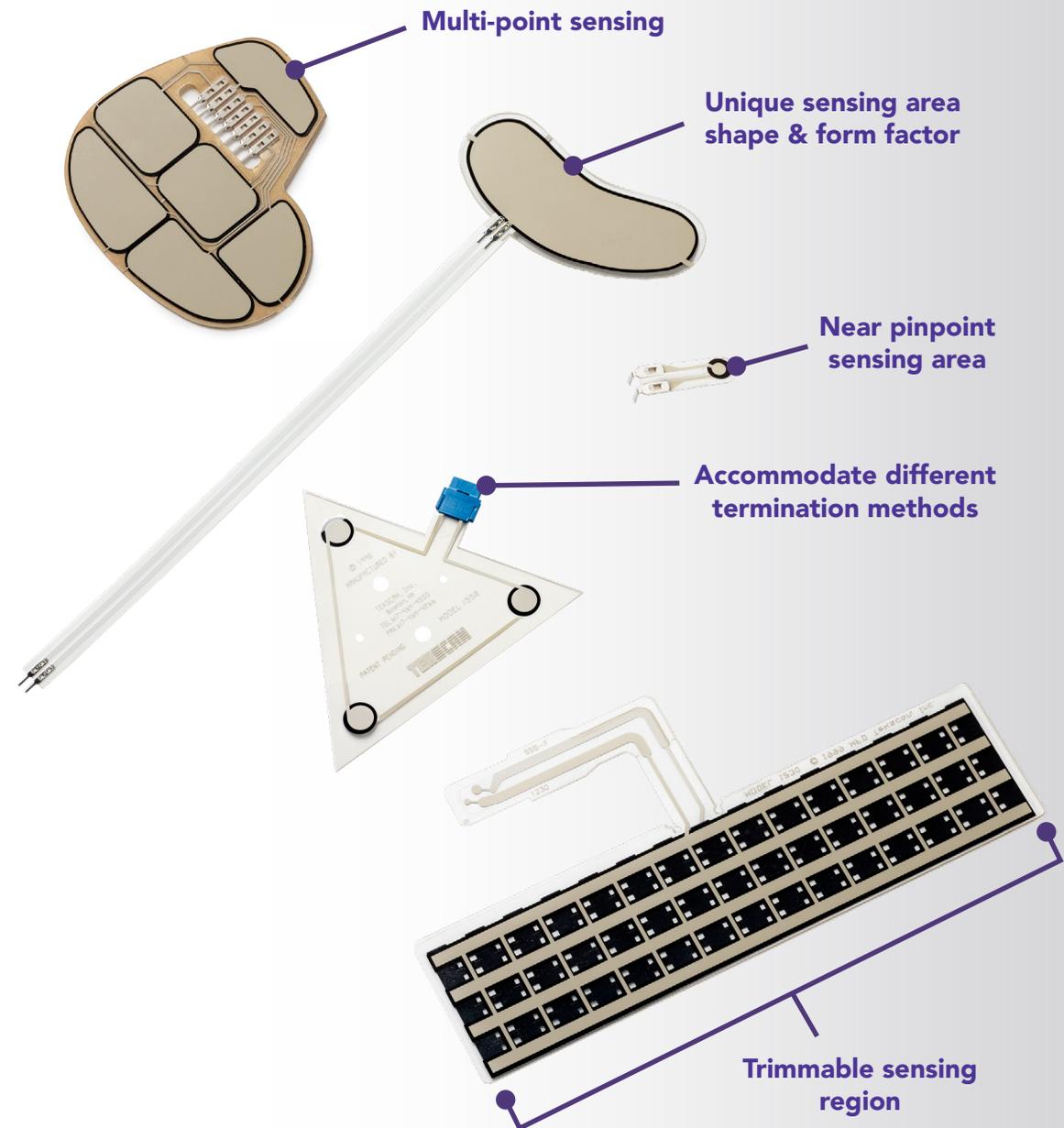
Ready to invest in a high-volume custom sensor? You're in luck. Tekscan has worked with hundreds of design engineers across a wide range of industries to develop custom force-sensing solutions to meet very specific needs.

HOW TEKSCAN HELPS YOU SAVE: A Smooth, Collaborative Customization Process

FlexiForce sales engineers will work to meet your goals and keep within budget from sensor design concept through completion and delivery. All final testing criteria are reviewed by Tekscan to ensure a robust final sensor design. This step confirms that all production expectations are clear from a timing and volume perspective.

FlexiForce customization capabilities:

- **Sensing area size:** FlexiForce sensors have been manufactured with active area diameters as small as 1.86 mm (0.04 in) and widths as large as 402.65 mm (15.85 in)
- **Pressure range:** Up to 10,000 psi
- **Operating temperatures:** Sensor options available to withstand up to 200°C (400°F)
- **Designs for multi-point sensing:** Instead of creating single-point sensors with large sensing areas, consider a design with multi-point or matrix sensors to capture forces from specific points of the application
- **Sensor designs with trimmable areas:** Your sensor can be designed to be modified on-the-fly to accommodate applications of different sizes or areas. This helps reduce costs of developing multiple sensor models



PERSONALIZED SERVICES AND VALUE-ADDED RESOURCES

The job of a design engineer can be rather solitary. While it may seem more efficient to “go at it alone” when developing a new product or device, enlisting the help of experts in a specific field of technology can help improve the efficiency and reduce the risk of costly redesigns.

HOW TEKSCAN HELPS YOU SAVE: We’re Engineers, Too!

In fact, all of our team members have technical backgrounds, and some have held positions as design engineers themselves at some point during their careers. Their mastery of the FlexiForce product line will be valuable not only in helping to develop the ideal force sensing solution for your application, but also ensure that your application will meet the mechanical and electrical requirements for optimal success.

- Application engineers have helped develop products and devices, from robotics, to industrial controls, and medical devices. This experience is especially useful where regulatory stipulations require very specific design needs
- Our longevity is no accident: Tekscan has brought several innovations and improvements to force sensing technology by making our own capital R&D investments to advance processes and capabilities
- **The OEM/sales/application engineering team partnership is a key reason why Tekscan has remained a stable company for over 30 years**

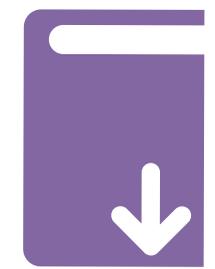
Download These Free Resources to Assist You on Your FlexiForce Integration Process

[FlexiForce OEM Design Portal](#)

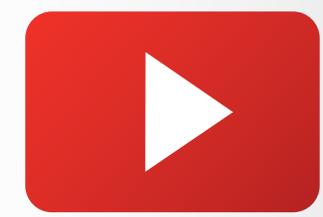
Click Here to Access These Important Resources



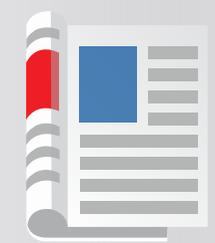
[Design Tips & Application Stories from “Tactile Touchpoints” FlexiForce Blog](#)



eBooks



Video



Industry Articles

CONCLUSION

Smart Decisions Save Time, Money, and Stress

As a design engineer, curiosity is in your DNA. Embedding technology to advance a device concept from a prototype to completion is a thrilling experience. Given the multitude of embedded force sensing technologies at your disposal, it's easy to get lost in the possibilities.

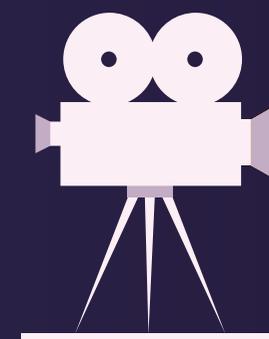
Even if FlexiForce touch sensor technology isn't the best fit for your application, we hope the guidelines provided in this document will help hone your focus to get the maximum return on investment.



**Ready to Take Your Device to the Next Level?
Let's start a conversation.**

We at Tekscan understand the challenges design engineers face, and the risks they take when embedding new technology. Whether it's a standard FlexiForce sensor or a custom design, Tekscan has a proven track record for helping design engineers achieve high-value products with force sensing technology. Your return on investment comes in the form of confidence in your product design, a shortened development process time, and an improved end user experience.

**Visit www.tekscan.com/es or call
1.800.248.3669 / +1.617.464.4283
for more information.**



Visit the FlexiForce
YouTube Channel



CLICK HERE!

