DRAS®: A Flexible Multi-Touch Sensing Technology

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Abstract

R&D CORE has developed a revolutionary, patent-pending sensing technology (DRAS®) that allows the creation of large, flexible, multi-contact, force sensing touchscreens. The technology is based on a Digital Resistive Area Sensing principle. This technology can be integrated with flexible electronic displays to enable the next generation of fully interactive flexible display devices such as mobile phones, e-book readers, smartwatches, smart clothes or large scale flexible TVs. The sensing technology can be used to detect common interactive gestures such as tapping, pinching, and swiping, to detect handwriting, to measure finger force.

Fig. 1 - Touchscreen placed behind a flexible display

Background

Flexible electronic displays have great potential in the future of portable electronic devices such as e-book readers, mobile phones, electronic newspapers / magazines, gaming consoles, point of sale labelling and smartwatches. Although there are still a few technological obstacles that hinder the commercialization of truly flexible display products, the first products with a curved, but not flexible, display have made their appearance in the market. These products are expected to be the precursor of the truly flexible display versions, most likely to first appear in smartwatches and mobile phones.

Despite the many encouraging developments in the field of flexible displays and the media attention the subject is attracting, there has not been a corresponding progress in the field of flexible touchscreen sensors that can be integrated with such displays. Most portable rigid display devices offer touchscreen functionality, which the public has grown to take for granted in all smart devices. Therefore, touchscreen sensing is a critical requirement in the success of most flexible display products. Which technology can best fit the needs of the upcoming next generation smart products?

The two main touchscreen technologies that have dominated the rigid display market are based on the analogue resistive (4 or 5 wire) and the projected capacitive principles. The latter has practically dominated the market primarily because of its visual clarity (thanks to using glass substrates as opposed to flexible plastic sheets), their responsiveness (they detect proximity/touch as opposed to force) and their ability to detect multiple, concurrent finger touches. On the other hand, resistive touchscreens have benefits in many other fronts, such as accuracy, low-cost, simplicity of electronics, etc. but in overall the trade-offs for smart devices have been against them.

Nonetheless, the introduction of flexible display products introduces some interesting touchscreen sensor requirements that necessitate the re-evaluation of the most promising technology. A truly flexible display will require a truly flexible touchscreen sensor. Inevitably, this translates to using flexible plastic substrates as the carrier for the touchscreen's electrodes. With this in mind, the projected capacitive touchscreens will no longer be able to use glass, therefore, their visual clarity will match that of resistive touchscreens. On the other hand, conventional resistive solutions still suffer from a key limitation, the inability to sense more than one contact.

Further, there are many other new requirements that any touchscreen technology will need to meet to succeed in the portable flexible display market, e.g. immunity to water/rain or wide temperature conditions, ability to recognize hand-writing (for drawing sketches / annotating or inputting script-based languages such as Chinese, Japanese or Korean), extremely low power consumption, rugged-

ness, immunity to accidental touches, simplicity of the hardware interface and low integration cost.

Summary of DRAS® Technology Benefits

R&D CORE has developed the Digital Resistive Area Sensing (DRAS®) technology that addresses all of the new touchscreen needs. Table 1 compares the performance of conventional analogue and projected capacitive sensors against DRAS sensors on all key touchscreen features that are relevant to smart flexible display devices.

It is evident that the DRAS technology emerges as the winning solution. It can detect more than one contact, it can sense finger force, it offers superior spatial resolution, it does not require re-calibration, it is not affected by humidity or temperature swings, it only picks up intentional contacts and it consumes very little power while the integration with a display is straight-forward. Furthermore, it works with gloves, which is an important requirement for outdoor use in cold environments. Of course, the technology is inherently shatterproof and borderless, i.e. it does not require a bezel.

In contrast, capacitive sensors cannot detect force, they are too sensitive to accidental touches, they have worse spatial accuracy, they cannot be used with gloves, they become inoperable if their surface is wet, they require complicated electronics that draw a lot of power and the cost of making them borderless is rather high.

Another important feature of the DRAS technology that is applicable to larger scale flexible displays is its scalability. Specifically, the sensor can be made as large as the application requires without increasing the complexity of the hardware interface and without compromising the sensor performance.

The technology consists of the sensor, the interface electronics and the software needed to identify contact area, contact position and contact force.
R&D CORE's technology enables the introduction of flexible display electronic devices into the market without forcing end users to accept a performance / functionality / usability compromise in regards to touch interactivity.

After considering the new requirements the flexible display applications introduce, it becomes apparent that capacitive touch sensing is no longer the best technology. Conventional resistive touchscreens are not ideal either.

"The DRAS technology addresses all of the new needs and emerges as the winning solution for the new breed of portable devices with flexible displays. "

Table 1 – Benchmarking DRAS® sensors against Analogue Resistive and Projected Capacitive touchscreen technologies for use in smart flexible display devices.

	Resistive		Capacitive
Properties	**Analogue**	**DRAS**	**Projected**
Flexibility	Yes	Yes	Yes
Multi-touch	No	Yes	Yes
Force / Contact Area Sensing	No	Yes	No
Stable Calibration	Poor	Great	Great
Optical Performance	Good		Good
Spatial Resolution / Accuracy	Great		Moderate
Sensitive to Humidity / Water	No		Yes
H/W Complexity	Low		High
Works with gloves/pen	Yes		No
Handwriting Recognition	Yes		No
Responsiveness	Force		Touch
Power Consumption	Low		High
Frame Rate	High		Low
Borderless	Yes		Possible
Cost	Low		High