

An Expert's Guide

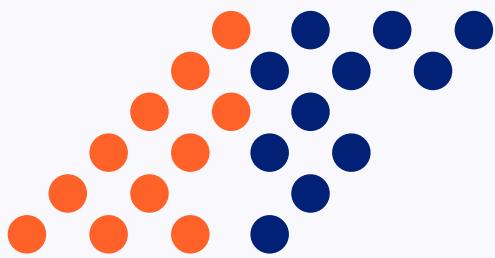
How to Select the Perfect Touch Sensor IC

Whitepaper



**Save by quality,
not on quality**

riverdi.com



*Take the best that exists and make
it better. When it does not exist, design it.*

Sir Henry Royce

Make it real with  **Riverdi**

Touch is king in human-machine interaction

Displays are revolutionizing the use of devices in virtually every area of life. Providing the best image is an obvious and fundamental issue here.



Kamil Kozłowski
Riverdi Ceo

But how the device will be seen later by its user, depends on how it is easy to operate it. Having well tuned and perfectly working touch under our fingers defines the product as a high-end device.

A CLEAR, STEP BY STEP GUIDE

How to select the right touch sensor IC

In this Whitepaper, you will:

- Learn more about touchscreens and key criteria for choosing the best touch sensor for your specific needs as an engineer and decision-maker.
- Get a framework with clear yet concrete steps based on a thorough analysis of touch controllers and design.
- Learn which factors to consider and which to avoid, letting your decision-making process be more accurate and easier.

KEY CRITERIA

The importance of R&D choices

Human-oriented thinking should guide us throughout the entire design process. We need a deeper understanding of what Touch Sensor IC is and what are its key features. We will use this knowledge consciously to achieve the perfect touch performance:

- **Touch accuracy** - precision, response time, multi-touch capabilities
- **Noise immunity** - incl. Electromagnetic Compatibility (EMC)
- **Compatibility** - correct IC choice and its seamless work with the chosen display technology



In order to develop parameters that ensure a smooth user experience, we will go through the following issues:

- User environment
- Reliability
- Touch performance requirements

DEFINITION

Touch sensor IC is...

...practically a small wafer holding from hundreds to millions of transistors, resistors, and capacitors. But functionally it is an Integrated Circuit converting an input finger signal (or other touch on a surface) into a measurable touch positions on the screen.

#1 Select touchscreen type and grade

Overview of touchscreen technologies

Projected capacitive (PCAP)

- + Works with water, thick gloves, multi-touch, severe electromagnetic interference.
- + Highly customizable and very durable.
- + Light and aesthetic.
- More expensive than the resistive
(but in the long term, much more cost-effective)

Resistive

- + Cheaper to manufacture: for budget, consumer-grade devices.
- Outdated, less responsive to touch, limited multi-touch.

Infrared

- + Highly sensitive: does not require direct touch, responds to any object interrupting the infrared beams.
- Environmental low resistance: can be affected by external light sources, dust, and dirt.

Surface acoustic wave (SAW)

- + Highly accurate: offers precise touch detection.
- Expensive and sensitive to contaminants.

RECOMMENDATION

Choose PCAP over older technologies

While we still manufacture older resistive and infrared touchscreen technologies, their applications are highly specialized. Riverdi recommends **projected capacitive technology** for most scenarios, except in rare cases where its implementation is impractical.

Currently, **99% of touchscreens are PCAP**, making them undisputed standard. The higher cost of their production pays off due to their longevity, durability and the ability to customize to practically any specification.

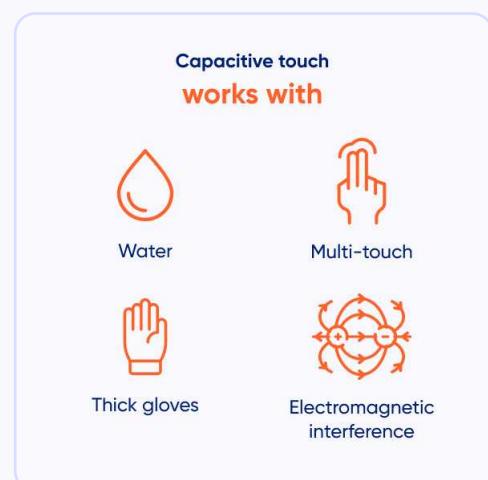
Consumer vs. Industrial-grade

Kamil Kozłowski
EXPERT INSIGHT

Projected capacitive screens offer significant advantages but can be unsuitable if not properly designed or selected for a specific device. For consumer-grade products, the challenges are minimal. However, for industrial, public space, medical, or military touch screens, the requirements become much more specific.

At Riverdi, we provide industrial-grade as standard for every product in our offer. Therefore, our design and testing processes are carefully prepared to meet the demands of your industrial application:

- **Durability in harsh environments.** Extreme temperatures, vibrations, water, chemicals, dust, electromagnetic noise
- **Customization.** For your environmental, functional, aesthetical and branding needs



#2 Framework with key factors in selecting a touchscreen

We have already made the initial technological choices. Now, still at the beginning of the process, we need to make key decisions related to the touchscreen use case.

Follow the checklists to analyze where the touchscreen will be used, how the environment will affect its operation and how it should be mechanically built.

CHECKLIST

Environmental conditions

SELECTION	FACTORS/ACTIONS
Indoors or outdoors	Determine where your device will be used
Thicker glass	Address the potential requirement for vandal-proofing in public spaces
Gloves and instruments	Consider the need for special operator equipment, like thick working gloves for heavy-duty tasks, nitrile gloves or styluses
Water-proof touch screen	Recognize the need for moisture-proof solutions
Chemical-resistant screen	Consider from the damaging point of view what kind of chemicals will be used to clean the touchscreen

CHECKLIST

Use case

TOUCH MODE	USECASES	EXAMPLES
Single touch	Simple selections	Widely applied in devices where one input per touch point is sufficient, allows most simple gestures like swipe or scroll
Button mode	Intentional touch	When touch certainty is critical, limiting multi-touch and gesture functions allows the controller to focus resources on ensuring touch accuracy - crucial for medical devices with vital functions, as well as parcel lockers, vending, and ticket machines
Multi touch	Advanced gestures	Multiple touchpoints designed for gestures similar to consumer-grade applications (like swipe, pinch, zoom in and out) - required for industrial devices with advanced interface

CHECKLIST

Mechanical requirements

- Analyze the level of sealing and waterproofing that you need: **full water-proof or lower IP rating** (e.g. raindrops)
- Remember that **the size and type** of the touchscreen must align with the overall design of the device.

Pro tips in decision-making

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- Single-touch mode** is easier to manage in environments with raindrops or water.
- Multi-touch mode** requires industrial-grade controllers and tuning.
- Adapting the firmware** to the specific interaction mode enhances the touchscreen's performance and user experience.

#3 Choose the industrial-grade touch controller

Riverdi's years of experience have led to creating touchscreens only with industrial controllers for both standard and customized solutions. In this step, you will understand why choosing industrial-grade is the best decision and investment—in terms of both reliability and safety even in the most extreme conditions.

We also design our touch panels with proper grounding and Flexible Printed Circuits (FPC). All this must withstand electrostatic discharge (ESD) tests. By ESD we mean a sudden flow of electric current between two differently charged objects that can affect the proper operation of the device by turning it off or resetting it.

WHY INDUSTRIAL-GRADE

Medical case

Many of Riverdi's clients in the medical industry require touchscreens that **can handle up to 15 kV of air discharge and 8 kV of conducted discharge**. Meeting these high thresholds demands rigorous design and testing protocols to ensure device reliability.

To achieve these high ESD levels, **PCAP touchscreens require customization and tuning**, including the use of thicker protective glass, as standard configurations typically cannot withstand such extreme discharge events without proper adjustments.

ENSURE PASSING

Even the most demanding certification tests

Depending on your exact criteria and requirements, we can fine-tune every Riverdi's touchscreen. For customers needing to pass demanding, e.g. medical certification, we design our touchscreens with proper grounding, controllers, FPC, and sensors to withstand any electrostatic discharges. With Riverdi's standard and customized products, you can be confident in passing even the most rigorous medical testing.

PRO WIN

Build or rebuild your display for any application

Because we use only industrial-grade technology you are able to adjust your touchscreen to:

- withstand **indoor challenges** like electromagnetic noises,
- extreme **outdoor requirements** discussed on the previous page like thicker glass as a vandal- and waterproof solution or the ability to operate the screen with gloves.

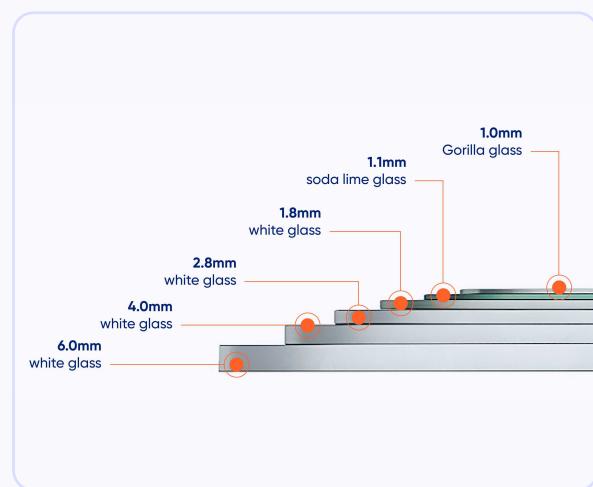
All our **standard industrial touch panels** come with **0.7 mm or 1.1 mm** cover glass, which is the base for our touch and smart displays. Such thickness is enough in most applications, but when a **thicker cover glass** is required, we can offer PCAPs with cover glass thicknesses ranging from 1.0 mm to 6.0 mm, including Gorilla® Glass.

WHY INDUSTRIAL-GRADE

Factory case

A typical manufacturing site is characterised by significant environmental electromagnetic interference. **Consumer-grade** touchscreens may not work in such conditions, leading to many **phantom touch events**. This can be a major problem, as operating machines may cause damage to employees or materials produced.

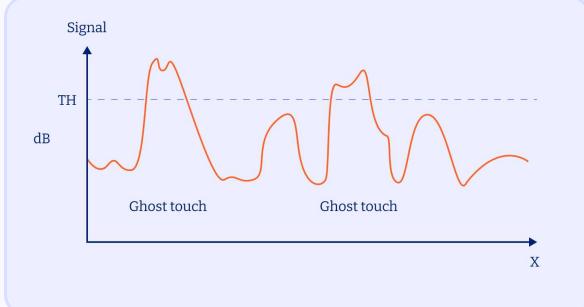
Fortunately, industrial-grade controllers solve such electromagnetic interference problem. On the next page you will follow the detailed problem-solution path for this critical issue of phantom touch events.



#4 Solve touch sensitivity problems with SNR

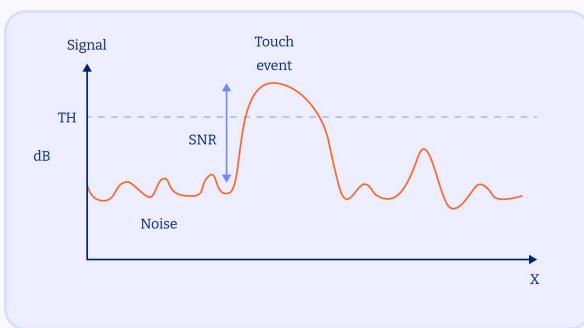
Problem:

You are using **thick glass** and you need the **signal level** to be high enough to reach the required threshold. If you have a **consumer-grade** controller, it is too weak to effectively suppress noise and prevent phantom touch events.



Solution:

The difference between the background noise that the controller can handle and the generated signal is called the **Signal-to-Noise Ratio (SNR)**. An **industrial controller** is superior because it has a higher SNR. SNR is typically measured in decibels (dB). A higher dB value indicates a better controller.



Pro tip #1

Make precise tuning to a touchscreen controller during an **early R&D stage**. Avoid changes in design (like adding extra cover glass based only on datasheet) without having them thoroughly tested before production.



Pro tip #2

Choosing your touchscreen controller for demanding applications? **Always prefer industrial** over consumer-grade. Industrial-grade will **perform better** and allow you **more control** over parameters like SNR.

Always check the datasheets

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To sum up, you can expect that the industrial controller will have **higher SNR** than the consumer grade controller.

Unfortunately, **not all manufacturers inform** about the SNR in their datasheets. Therefore, be sure to check the documentation before making any decisions.

#5 Prevent instead of cure: Avoid common problems

Many customers have approached us because they needed help. One client purchased a display from another manufacturer that did not prioritize the industrial sector or properly prepare the displays. Learn from their experience to avoid critical issues.

Problem:

Certification failure

Initial situation:

An engineer purchases a display and creates a prototype. The touchscreen functions perfectly in a controlled laboratory environment.

Solution:

Use industrial-grade components **from the start**

Problem analysis:

However, the display fails to pass certification. This often happens, mostly due to two key factors:

- **Component integration:** the controller and sensor may not align with other device components, leading to issues in real-world conditions.
- **Production changes:** modifications during production can affect touchscreen performance, resulting in certification failure.

Addressing these factors early is essential for meeting certification requirements.

Problem:

Inability to support a thicker glass

Solution:

Select appropriate, industrial-grade controller **at the beginning of R&D**

Initial situation:

- Similarly to the previous scenario, the engineer evaluates the prototype and determines that it is perfect and ready for mass production.
- Later on, it turns out the device needs to be used outdoors and requires thicker, vandal-proof glass - 4 mm or more.

Problem analysis:

- The problem is that the initial, cheaper consumer-grade controller chosen by the designer cannot support thicker glass, which is common in this technology.
- The engineer decides to replace the controller. But this requires changing the touchscreen's firmware and protocol.
- This results in a complete device redesign, leading to costs comparable to starting the project from scratch.

Having trouble
tuning your display?

Feel free to contact us, even if it's not a Riverdi product. We can redesign your current display to improve its performance or select a new solution better suited to your application's needs.

Get in touch

#Summary Use an engineer-friendly unique buying process

Take unique Riverdi approach to gain maximum of effective freedom and reduce time and costs when starting a new project:



Whatever is your need

- Vandal-proof thicker glass.
- Screen able to work with water drops or gloves.
- Fine tuning of the controller.
- UV protection.
- Avoiding the blackening defect of the screen.
- Solving the issue of low remote power supply for high-brightness outdoor displays.
- Choosing USB or I2C interface to control a touch panel.
- Problems with your current solution e.g. using another manufacturer's older display technology.
- Looking to upgrade, refresh or add new features to your device.

We will help you address your touchscreen challenges and provide a better solution, making it easier to certify your device or adapt it to your required environment.

Not sure which technology or touchscreen to choose?

[Get in touch](#)

Guaranteed by Riverdi

Industrial-grade quality • Help in passing the certification • Work in harsh environments • Complete documentation • Quick TTM • Plug & play • No MOQ for standard • 95% OTD • Seamless supply chain • Continuous availability

Riverdi displays with PCAP

Our experts will help you with choosing the solution that fits your current needs.

HIGH BRIGHTNESS

IPS Displays

High-resolution TFT displays that redefine clarity and visibility across a broad spectrum of applications. With the integration of advanced interfaces such as LVDS, MIPI DSI, and RGB, these displays offer unmatched versatility and performance.



[Discover our displays](#)

Unique benefits of the series

- **Superior visual performance:** with surface luminance up to 1000 cd/m², Riverdi's displays guarantee visibility in even the most brightly lit environments, ensuring your message or content is always front and center.
- **Industrial-grade touch technology:** with ILITEK touch ICs and the ability to function in demanding conditions—including with gloves or water—Riverdi displays meet the highest standards of responsiveness and durability.
- **Wide viewing angles:** IPS technology ensures that images remain accurate and colors stay consistent, no matter the viewing angle, facilitating a natural and intuitive user interaction.
- **Comprehensive customization:** Riverdi empowers users to customize their display solutions to specific needs, offering options for touchscreens, mounting frames, brightness adjustments and cover glass modifications, among others.
- **Streamlined development process:** Riverdi's support for various interfaces and customization options simplifies the integration process, allowing for a quicker development cycle and easier implementation of innovative features.

Use cases and industries

- **Information kiosks and POS systems:** where clarity and visibility directly impact user experience and operational efficiency.
- **Medical and laboratory devices:** where precision and reliability are crucial.
- **Industrial controls and IoT devices:** where durability and performance are critical under varying environmental conditions.

HIGH PERFORMANCE

STM32 Embedded Displays

Unparalleled high-resolution displays powered by the robust STM32H757XIH6 microcontroller. Engineered for both indoor and outdoor applications, these displays are designed to meet the most rigorous hardware and programming requirements, setting a new standard for display technology.



[Discover our displays](#)

Unique benefits of the series

- **Superior resolution and brightness:** at 1280x800 pixels, these are among the highest resolution STM32 screens available.
- **Fully customizable with robust performance:** designed with commitment to modularity, engineered for durability and longevity, ensuring reliable performance in even the most demanding conditions, reducing maintenance and replacement costs.
- **Advanced STM32 MCU technology:** the dual-core STM32H757XIH6 MCU integrates high-performance Arm® Cortex®-M7 and Cortex®-M4 cores, offering exceptional processing power, floating-point unit support and comprehensive security features.
- **Diverse connectivity options:** with a multitude of interfaces including USB, RiBUS, RS232, RS485, CAN and more, offering unparalleled flexibility for integration into various systems and applications.

Use cases and industries

- **From advanced HMI and medical devices to IoT sensors and smart home appliances,** these displays are built to excel in a wide array of environments and use cases.

REVOLUTIONARY COMMUNICATION PROTOCOL

EVE 4 Intelligent Displays

Powered by the cutting-edge BT817Q graphics controller, the series represents the peak of smart display technology. Offering a seamless blend of audio, display and touch functionalities these high-brightness IPS intelligent displays redefine what's possible in the realm of interactive devices. Whether for upgrading existing systems or designing from scratch, the EVE4 series stands as the smart choice for any application, pushing the boundaries of display technology into the future.


[Discover our displays](#)
Unique benefits of the series

- **Integrated video processing:** The EVE4 series introduces an intelligent approach to display technology, where the video processing unit is integrated with the display, enabling it to process images independently and efficiently.
- **Advanced BT817Q graphics controller:** supporting higher resolution modes up to WXGA (1280 x 800 pixels) and delivering superior performance in graphical processing and touch responsiveness.
- **Industrial-grade touch screen:** the integration of the ILITEK Touch IC- ILI2132A touch controller, guaranteed for 10 years, makes these displays suitable for rugged industrial applications, capable of functioning in extreme conditions and responding to gloved touch.
- **Customization and flexibility:** allowing changes in cover glass, interface enhancements and specific adjustments to meet unique medical, industrial and military project requirements.
- **Cost-efficiency:** while offering advanced features, the intelligent design of the EVE4 series contributes to the overall cost-efficiency of devices by reducing the need for additional processing hardware and simplifying the development process.

Use cases and industries

From advanced **HMI**s and **medical devices** to **military equipment** and **smart home appliances**, the EVE4 series provides a reliable display solution across a spectrum of applications.

HIGH RESOLUTION, HIGH BRIGHTNESS

HDMI Displays

Riverdi's HDMI display series offers a high-quality, plug-and-play display solution designed to meet the needs of end users and modern engineers, enabling connection to any HDMI external input. With advanced features and powerful performance, they are perfect for a wide range of applications, providing both flexibility and reliability.


[Discover our displays](#)
Unique benefits of the series

- **Plug-and-play integration:** with no need for complex setups or driver installations, it enables engineers to simply connect and start using immediately.
- **Versatile connectivity:** compatible with various devices via standard HDMI, ensuring broad compatibility across systems, the displays can be connected directly to a PC (Windows/Linux) or any SBC (i.e. Raspberry Pi).
- **Long-term availability:** guaranteed long product life cycle, ensuring consistency and reliability in long-term projects.
- **Internal and external backlight PWM control:** with multi-functional OSD menu so that you can adjust: brightness, contrast and saturation.
- **High-quality image and rugged design:** built for sharp images and durability, with industrial-grade components that withstand harsh environments

Use cases and industries

From advanced **industrial automation** and **medical devices** to **digital signage** and **consumer electronics**, providing end users with high-quality, responsive interfaces for home automation and entertainment systems. With the extremely popular HDMI interface these displays are worth choosing for their ease of integration, long-term availability, and superior visual performance.

Kamil Kozłowski

ENGINEER, AUTHOR, RIVERDI CO-CEO

He began his adventure with electronics at the age of 11 by constructing a flashing diode. He went through the entire path from an electronics engineer with a diploma to a serial entrepreneur with a knack for turning innovative ideas into reality. In 2022, the company he built with his partners has become a leading global manufacturer of industrial-grade displays and innovative touchscreen solutions.

The CEO of Riverdi since 2020, previously held the role of Co-Founder & CTO from 2014. Prior to that, Kamil was a Co-Owner & VP at Unisystem starting from 2010. Additionally, he is also a Co-Owner and Board Member at Lummico since 2021.

Kamil Kozłowski received a Master of Science degree in Electrical, Electronics and Communications Engineering from Gdańsk University of Technology between 2005 and 2010.



Riverdi is a global manufacturer of high-quality display solutions, committed to providing innovative and reliable products for various industries. We guarantee prompt and **on-time delivery with low-risk processing** and a highly effective **Vendor Managed Inventory system**. Our mission is to empower engineers and designers with user-friendly, high-performance displays that drive the future of technology.

We target companies, organizations, and entrepreneurs, who need reliable display technologies to create user-friendly products. We are also a tech company and know the importance of operational efficiency and direct access to cutting-edge solutions for business—with full availability of **R&D, transparent documentation and engineer support**. Thanks to that understanding, for over 10 years we have successfully provided both standard and **easily customized** displays to clients in the medical, beauty, industrial, digital signage, and laboratory businesses.

Our extensive display offer has made Riverdi a household name among customers around Europe, USA and internationally. Those who decide to trust our solutions always put our quality standards and processes first, which is why our motto is:

**Save by quality,
not on quality**



Save **by quality,
not on quality**

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