MICROCHIP

Touch and 3D Gesture Control
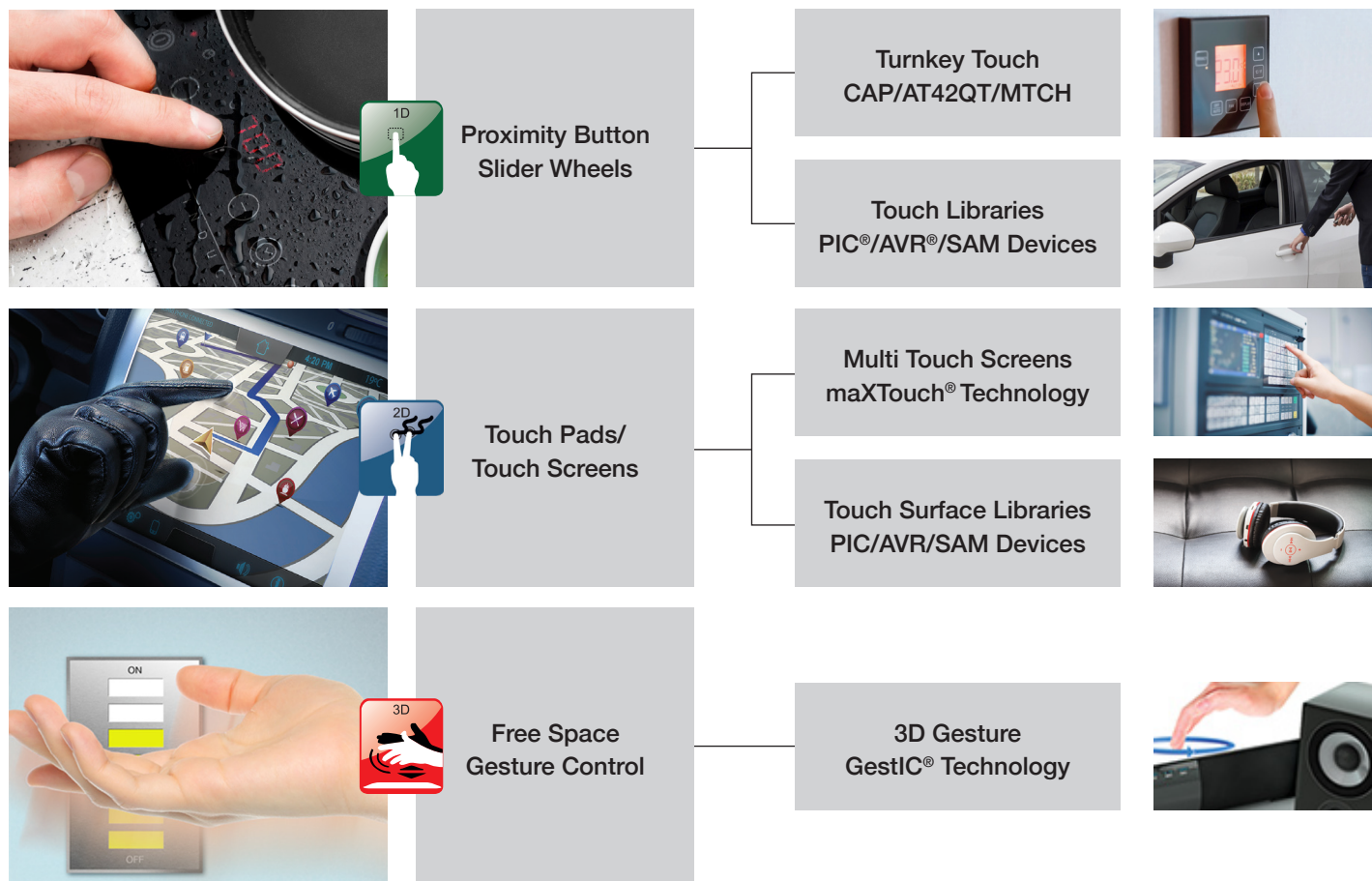
www.microchip.com/touch

Microchip offers a solution for every touch use case – from single buttons to touch pads and touch screens to proximity detection and to 3D gesture control for every market.

Microchip's touch solutions excel based on our deep knowledge and experience in touch. Regardless if you choose a touch turnkey product or a touch library for an MCU – you always benefit from decades of touch experience.

- Water-tolerant touch buttons/wheels/slider for automotive, industrial and consumer
- Touch on metal (waterproof)
- Touch libraries for PIC®/AVR®/SAM devices
- IEC/UL 60730 class-B certified safety touch

- Low-power touch pads
- Surface gesture detection
- Multi-touch screens for automotive and industrial
- 3D hand gesture recognition for automotive, industrial and consumer

- Proximity, buttons, sliders, wheels (1D)
- Touch pads and multi touch screens (2D)
- Free space Gesture recognition (3D)
- Proximity detection and spacial detection for touch screens

1D Proximity Button Slider Wheels	**Turnkey Touch** CAP/AT42QT/MTCH	
	Touch Libraries PIC®/AVR®/SAM Devices	
2D Touch Pads/ Touch Screens	**Multi Touch Screens** maXTouch® Technology	
	Touch Surface Libraries PIC/AVR/SAM Devices	
3D Free Space Gesture Control	**3D Gesture** GestIC® Technology	

Technologies

- Adaptive noise avoidance
- Water-tolerant touch buttons
- Water-tolerant touch pads and screens
- Touch hardware solutions on MCU

- Driven shield (multiple)
- Feeding line compensation
- Low-power sensor lump
- Mutual
- Self

Use Cases

- 3D Gestures
- Grip sensing
- Hands-on detection
- Touch screen
- Touch pad

- High button count
- Proximity
- Wheels
- Sliders
- Buttons

Why Microchip Capacitive Touch?

From Your Customers Perspective the User Interface is the Product

Innovative, modern and attractive selling products all have one thing in common; they all have a user-friendly touch interface.

Adding touch to your product adds value to your product. Furthermore, interfaces with mechanical push buttons have several moving parts, which significantly decrease reliability. In addition they also require complex design and assembly as well as a major investment in tooling.

Microchip touch solutions elevate your product while decreasing total system cost, which benefits you and your customers. Enhancing your products with a touch User Interface (UI) is the right first step—Microchip's touch solutions support your journey and add two main benefits:

Save Valuable Time in Touch Development

Shortening the amount of time it takes to go from development to product launch is essential for your revenue stream. Microchip offers two main roads for you to accelerate development of your touch-enabled products.

Turnkey Touch Products

Turnkey touch controllers provide the fastest and easiest way to go from mechanical buttons to modern touch buttons or displays with touch. Our turnkey touch products include off-the-shelf controllers for touch buttons, sliders and wheels as well as controllers for touch pads, touch screens and proximity solutions for consumer, industrial and automotive applications. All controllers communicate to the host via standard serial interfaces, such as I^{2}C, SPI or USB as well as GPIO output.

Microcontroller Touch Integration

Microchip offers a wide range of 8-, 16- and 32-bit devices with our PIC, AVR and SAM MCU and MPU series. All of these platforms enhance touch with dedicated on-chip touch Core Independent Peripherals (CIPs).

Microchip's touch library supports each platform enabling you to easily access Microchip's decades of experience in capacitive-touch design. To save code space, enhance usability and speed up the development of your touch project, Microchip provides the touch library individually tailored to your use case via MPLAB® Code Configurator (for PIC MCUs) and Atmel START (for AVR/SAM devices).

Implementing touch on an MCU has never been easier!

Microchip's Performance Advantage

Regardless if you chose a turnkey touch product or a touch library to integrate with your code—you will benefit from Microchip's performance in touch.

Noise Robustness

Noise, also known as conducted noise, is a common challenge for touch implementations. Microchip provides state-of-the-art software and hardware filters to overcome noise. Noise-avoidance technologies, such as frequency hopping are used.
- High Signal-to-Noise Ratio (SNR)
- IEC61000, EFT and BCI tested

Water-Tolerant Touch

Water-tolerant touch is a key feature that Microchip has integrated into turnkey and MCU-based touch solutions. Users expect their touch interfaces to work well in a range of conditions (including wet surfaces) without the need to clean their hands or wipe them dry every time they use their devices.

Microchip offers integrated hardware to achieve industry leading water-tolerant touch for buttons, sliders and 2D touch pads.

Touch on Metal – Waterproof Touch

Microchip offers Metal-over-Capacitive (MoC) technology enabling:
- Metal surfaces, stainless steel or aluminum
- Sense through any thickness of glove
- Waterproof designs
- Braille-enabled interfaces

Metal-over-capacitive technology is compatible with all turnkey and MCU-based touch products.

Low(est) Power

Requirements for low power are not limited to wearable devices—it's a welcome addition in all markets. Dedicated hardware on PIC, AVR and SAM devices enable the lowest power touch with capacitive sensing below 5 µA.

High Button Count Support – Mutual Touch Sensing

Microchip has refined and enhanced the method to scan a large number of buttons as a matrix. Mutual touch enables costs savings in many aspects:
- Reduced amount of feeding lines to slim connecting (flexPCB) tails
- Reduces pin count required for touch to enable cost-efficient small-footprint parts
- Dramatically reduced development time by Microchip's unique inherent feeding line length compensation

Safety-Certified Touch Sensing

Functional safety, Failure Modes and Effects Analysis (FMEA) is a market driver for touch. For the market of appliances, Microchip offers products (turnkey and libraries) certified according to IEC/UL 60730 Safety Class-B standards. Certificates are published on Microchip's website at www.microchip.com/touch.

1D

Turnkey Touch Products

Our turnkey touch products pave a straight path for you to implement touch to your user interface - e.g. the MTCH products enable you to replace mechanical buttons without any further changes at your product, touch, plug and play. With a streamlined and touch-focused functionality, as well as simple GUI-based configuration, they offer the shortest time to market. Starting with a single button, to sliders, wheels and up to 64 buttons—Microchip offers fast and reliable turnkey touch solutions.
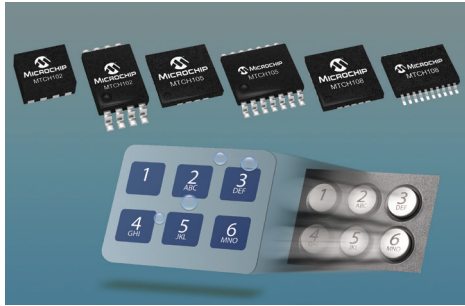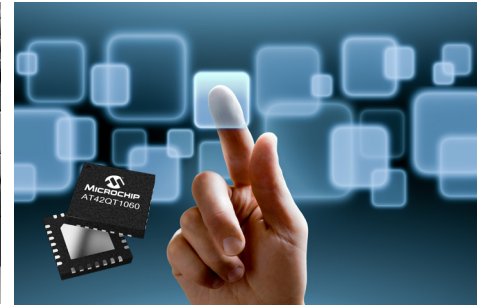

MTCH10x

- 1 to 8 sensing channels
- Digital output
- Water-tolerant touch
- Simple tuning process
- Direct button replacement

CAP1xx

- 3 to 14 sensing channels
- I^{2}C interface
- Water-tolerant touch
- LED driver—high resolution PWM

AT42QTxxxx

- 1 to 64 sensing channels
- UART/SPI/I^{2}C interface
- EN/IEC 60730 certification on AT42QT1481 and others

Touch on MCUs – Microchip's Touch Libraries

Microchip offers complete touch libraries and industry leading tools to enable touch sensing on all our PIC, AVR and SAM devices. All platforms support touch by hardware through Core Independent Peripherals (CIPs). These "MCUs with touch" ensure a smooth integration with any other task as well as low power and water tolerance for your touch designs.

Microchip provides touch libraries to ensure performance, reliability and to speed up your development process.
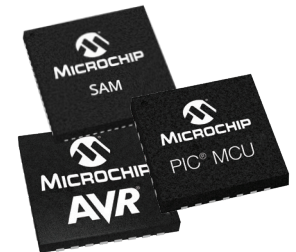
MCUs with Touch

Our MCUs feature dedicated CIPs to offload touch functionality from the MCU core.
- Hardware Capacitive Voltage Divider (HCVD) for PIC MCUs
- ADC^2 with Computation and HCVD for PIC MCUs
- Peripheral Touch Controller (PTC) for AVR/SAM devices

These touch modules support self-and mutual-capacitance measurements, providing you with greater flexibility. Due to the autonomous operation, CPU resources and power consumption are minimized, even for high key count designs. With built-in automatic tuning and calibration, Microchip provides the highest quality of touch even under harsh environments.

Our MCUs with Touch Provide You with the Flexibility You Need

- 8/16/32-bit platform
- Smallest packages include WLCP
- Cost in production minimized with SOIC/SSOP
- From 6-pin to 144-pin devices, up to 1 GB KB Flash memory
- On-chip integration options include USB, CAN, LIN, IrDA®, wireless protocol stack, segmented LCD and graphics

Software Development Tools

Microchip supports touch configuration right from the Integrated Development Environment (IDE). Graphicaly, you can configure your touch design easily and the IDE generates ready-to-use code.
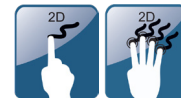- MPLAB X IDE features MPLAB Code Configurator (MCC)
- Atmel Studio 7 features Atmel START

Our development environments are also available in the cloud, giving you the fastest access to the broadest MCU portfolio with touch.
- mplabxpress.microchip.com
- www.microchip.com/start

START

MPLAB® CODE CONFIGURATOR

2D Touch Sensing – Touch Pads and Touch Screens

Microchip, as the leading provider in touch technology, offers a wide range of solutions for 2D touch pads and touch screens for the consumer, industrial and automotive markets.

Our touch libraries focus on lowest-power 2D touch sensing, high level of MCU integration and on-chip surface gesture detection (swipes, taps, pinch/zoom)—features needed in wireless headphones, remote controls or small touch pads on steering wheels.

The maXTouch® controller represents cutting edge technology for multi-finger touch pads and screens. maXTouch technology combines water tolerance, glove support, stylus and highest-noise robustness for automotive and industrial applications.

2D Touch Libraries – 2D Touch on MCU

2D Touch on MCUs is a solution for smaller touch pads and touch screens. The key element is the integration of the user interface into the main controller of your device. Instead of a dedicated touch controller your main MCU with the 2D touch library from Microchip is enabled to integrate that function.

Our 2D touch surface libraries are available for 8-bit PIC and AVR MCUs controller and 32-bit SAM MCUs, which are three low-power and cost-efficient platforms.

2D Touch for Embedded Devices

The massive adoption of smartphones and tablets with capacitive touch-screens has raised the expectations for user interfaces in every product. Customers expect a "phone like" user interface on a variety of products including wearable/IoT devices, remote controls, audio devices and more. These expectations are paired with requirements like low-power consumption, small footprint and feature integration to enable new form factors:

- Headphones
- Remote controls
- VR/AR head sets

- IoT – home automation (connected light switches, thermostats)

- Smart speaker (home assistants)
- Touch pads on steering wheels

Features

At a minimum, 2D touch controllers deliver XY coordinate output. Our MCU-based touch pad/touch screen solutions add surface gesture recognition—enabling truly intuitive user interfaces. Our 2D Touch surface libraries support water tolerant touch pads as well as dual finger gestures such as pinch/zoom. Microchip provides all you need to elevate the user experience of your embedded product.

Tracking

- Single finger tracking
- Water tolerant
- 100 Hz+ report rate

Surface Gestures

- Single + dual finger tap, double tap, triple
- Single + dual finger long press
- Single + dual finger swipe and swipe and hold
- Single + dual finger rotations
- Pinch/zoom

Please contact your local Microchip sales team for immediate access to our 2D Touch surface library.

Turnkey Solution for Multi-Finger Robust and Reliable Touch Pads and Screens

The maXTouch touch controller family provides a leading projected capacitive technology for touchscreens and touch pads. It supports single-finger, multi-fingers and gloved-finger operation. Regardless of the operating environment—hot or cold, dry or wet, noisy power supply or strong radiating surrounding devices—maXTouch controllers are designed for robust and reliable operation without compromising touch performance.

The maXTouch portfolio covers solutions for all touch surfaces and touch screens up to 24" diagonal size. Additionally, I²C, SPI, and USB communication interfaces are available. maXTouch controllers embed best-in-class and proven touch algorithms which ease the touch system development and significantly reduce time to market.
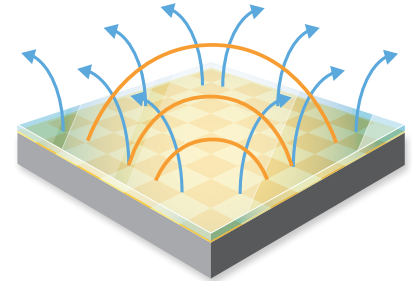
Exceptional Touch Performance

maXTouch technology combines the best of mutual and self-capacitance sensing method to ensure optimal touch performances.

Moisture Tolerance
- No false touch in the presence of water
- Reliable finger tracking through water droplets

Accuracy and Speed
- Up to 16 concurrent touch tracking
- Up to 250 Hz reporting rate with active noise filtering
- Below 1 mm linearity and accuracy
- Best edge performance

Support for Various Industrial Designs
- Thick front panel of glass or plastics
- Non-rectangular shape

Glove Support
- Multi-gloved finger tracking
- Up to 5 mm glove thickness

Embedded Touch Gestures
- Single-finger gesture such as tap, double-tap or flick
- Dual-finger gesture such as pinch and rotate

Outstanding Noise Immunity

maXTouch technology has superior Signal-to-Noise Ratio (SNR), which enables you to successfully combat various sources of electromagnetic interferences such as:
- Injected current noise
- Display radiated noise
- Backlight and motor radiated noise
- Fast transient current

maXTouch devices are built on a highly parallel sensing architecture and carry multiple hard-wired analog and digital filters. Combined with a high-performance and low-power CPU core, maXTouch devices are capable of maintaining a fast reporting rate and excellent touch performances in the presence of severe electromagnetic noise sources. Additionally, all maXTouch devices are designed to meet high Electrostatic Discharge (ESD) requirements.

maXTouch devices have an unmatched track record for touch panels in the automotive, home appliances, medical and industrial markets that have successfully passed the industry-related EMC standards.

Commercial and Industrial Devices

Typical Screen Size	Device	Package	Interface	HID (Windows®)	Passive Stylus	Gestures
1–4"	MXT144U-MAU	38-pin QFN	I²C	No	No	Single- and dual-finger
	MXT144U-UU	36-pin WLCSP				
3–7"	MXT336U-MAU	56-pin QFN			Yes	No
5–10"	MXT640U-CCU	88-lead UFBGA		Yes		
9–12"	MXT1066T2-C2U	144-lead UFBGA (HDI)				
	MXT1066T2-NHU	117-lead UFBGA (non-HDI)				
10–16"	MXT1664T3-C2U	162-lead UFBGA	I²C and USB			
	MXT1664T3-CCU	136-lead UFBGA				
14–24"	MXT2952T2-C2U	162-lead UFBGA				

Automotive-Grade Devices

Dedicated members of the maXTouch device family are specifically designed for automotive applications. These devices are AEC-Q100 compliant and fully automotive quali-fied. They are available as Grade 3 (−40 to +85°C) or Grade 2 (−40 to +105°C) variants.

Microchip's maXTouch automotive controllers are the first touch controllers to carry the Automotive SPICE Level 3 certification. All automotive maXTouch devices are available in QFP packages.

Typical Screen Size	Device	Package	Interfaces	AEC-Q100	Gestures
1–3"	ATMXT225TD-A	100-pin TQFP	I²C and SPI	Grade 3 (−40 to +85°C) Grade 2 (−40 to +105°C)	Single- and dual-finger gestures
4–5"	ATMXT449TD-A	100-pin TQFP			
6–7"	ATMXT641TD-A	100-pin TQFP			
8–9"	ATMXT799T-A	144-pin LQFP			
9–11"	ATMXT1189T-A	144-pin LQFP			
10–12"	ATMXT1665T-A	144-pin LQFP			
13–17"	ATMXT3432S-A	Chipset	I²C and USB	Grade 3	

MGC3030/3130 3D Gesture Controllers with GestIC Technology

The MGC3030/3130 are single-chip solutions to enable 3D gesture control in almost any product, such as wireless speakers, radios, light switches and remote controls. The MGC3030/3130 are optimized for embedded usage, require no host intelligence or resources and come with a complete gesture portfolio.

The Benefits of GestIC Technology

Similar to capacitive touch sensing, GestIC technology uses E-field sensing to detect gestures. Electrodes remain invisible behind the device housing, allowing an aesthetically pleasing industrial design without the need for holes or other cut-outs typically required for cameras or infrared-based systems. Further benefits include:

- Full surface coverage, no blind spots
- Lighting independent
- Build in adaptive noise filtering
- Only gesture solution with built-in auto wake/sleep
  - <100 µA sleep current
- Low system complexity and low costs

The MGC3030/3130 output direct and immediately usable results—everything is detected on-chip including gestures, approach, touch events and x/y/z 3D positions. The MGC3030/3130 controllers are true single-chip solutions for the next generation of user interface, enabling gesture-based UI applications for embedded products.

Fast, Precise and Robust

Implemented as a low-power mixed-signal System-on-Chip (SoC), the MGC3030/3130 controllers offer a rich set of smart-functional features including:

- 0 (touch) to 10 cm detection range
- Fast report rate up to 200 Hz (5 ms)
- Field upgradable on-board gesture suite
- Digital interface (I²C) and configurable GPIOs

On-Board Gesture Recognition

Gesture recognition is performed on chip to eliminate the complexity and need for additional processing, a unique feature to GestIC technology shortening your time-to-market. The gesture suite gives the MGC3030/3130 controllers the ability to recognize gestures while the rest of the system is powered down or in a power savings mode. It is field-upgradable to ensure your system can accommodate and use additional gesture algorithms as they become available.

Like speech and language, everybody's hand gestures have a unique quality that differs in timing, amplitude and other metrics. The integrated GestIC Technology Colibri Suite makes use of a Hidden Markov Model for high recognition rates of various gestures. This detects the subtle difference between deliberate gestures and general hand movement to limit response to unintended gestures.

Gestures

Approach Wake-up is primarily used to wake up the MGC3130 (and the rest of the system) when a hand approaches the sensing area.

Flick Gestures are available as swipes or edge flicks in four directions, and typically used for commands such as next, previous, on/off or up/down.

The **Airwheel Gesture** is an intuitive input for up/down adjustments to levels and values. The rotations are also detected on chip.

Sensor Touch detects touch, tap or double tap at any of the five receive electrodes. This is typically used for selection and confirmation commands.

The **Wave Gesture** registers small finger movements and differentiates in the x- and y-direction. Applications include shuffle play control in an audio device.

The **Hold Gesture** detects a steady hand to trigger events, best envisioned as the touchless enter key. Timing is configurable.

The **Presence Gesture** enables intelligent back lighting and in the simplest manner.

Position Tracking is available on the MGC3130.

Development Tools

To accelerate your development, Microchip offers easy-to-use touch development tools. For more information, please visit www.microchip.com/touch.

Turnkey Touch Development Kits

### MTCH10X Evaluation Board (DM160229)

The MTCH10X Evaluation Board provides an out-of-the-box experience for performance and the robustness of Microchip touch solutions.

CAP1xxx Evaluation Board (DM160222/23)

These kits provide an easy platform for evaluating and developing a variety of capacitive touch sense applications using the CAP11xx (DM160222) and the CAP12xx (DM160223) family. Both boards function as bridges for all other CAP1xxx devices as well.

Low-Power Projected Capacitive Touchpad Development Kit (DM160219)
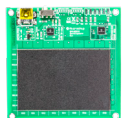
This kit enables you to quickly integrate gestures and 2D touch to your designs. The kit includes everything needed to create a rich user interface, including a USB connection to our GUI for customized solutions. Gestures and 2D touch are supported by MTCH6102, a low-power turnkey 2D touch controller.

MCUs with Touch Development Kits

QTouch technology evaluation kits such as the ATtiny817 Xplained Mini (ATTINY817-XMINI) or ATtiny817 Xplained Pro (ATTINY817-PRO) are available for all AVR and SAM MCUs with PTC. Complete touch kits, such as the ATtiny817 Water Tolerance Kit (ATTINY817-QTMOISTD) are also available.

Curiosity Development Board (DM164137)

Low-Cost mTouch® Technology Evaluation Kit (DM160227)

The Low-Cost mTouch Evaluation Kit provides a simple platform for developing capacitive touch sense applications using including water-resistant touch.

PIC/AVR/SAM MCU-Based Touch Library Solutions

For close to every Microchip MCU there is an Curiosity NANO/MINI or PRO or XPRO evaluation board available with touch electrodes. The boards are extensible with touch extension boards. Below is a small selection:

- ATTINY817-XMINI/ATTINY817-XPRO
- ATSAMD20-XPRO/ATSAMDA1-XPRO
- QT1 Xplained Pro Extension Kit (ATQT1-XPRO)
- QT3 Xplained Pro Extension Kit (ATQT3-XPRO)
- 2D Touch Surface Development Kit (water tolerant)
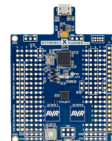
MikroElektronika click boards™
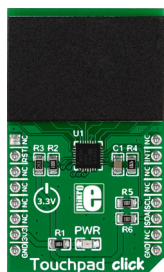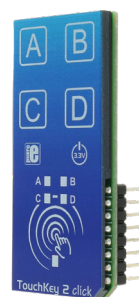
Mikroelektronika click boards are the easiest way to add sensors, human interface (touch) control, or wireless communications-interfaces to your design. Based around the mikroBUS™ interface standard, click boards add incredible capability to any system with ease. mikroBUS is supported by all MCU evaluation platforms from Microchip (such as the Curiosity or MPLAB Xpress series).

- TouchKey 2 click (MIKROE-2474)
- TouchPad click (MIKROE-1995)

Please find the latest at www.mikroe.com as the portfolio is growing.

1D 2D 3D

maXTouch Evaluation Kits

All of our Evaluation kits include a dedicated sensor with the flex connector and the electronic control board. Some evalutation kits include also converter board from either SPI or I²C to a USB interface to enable easy connectivity to the host, like your PC. All evalutation kits include the host software as well as the maXTouch Studio Light development tool.
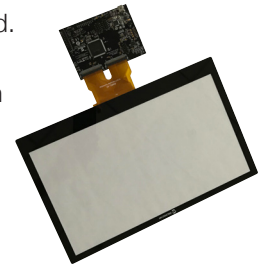
Evaluation Kit	Supported ICs	Sense Nodes	Sensor Matrix	Sensor Details
ATEVK-MXT225TAT	MXT225TD-A	224	19X x 11Y	3.5 inches Touchpad, PCB with 2 mm plastic lens
ATEVK-MXT641 TAT	MXT449TD-A, MXT641TD	640	30X x 19Y	8 inches (16:9), ITO G2, 1.1 mm glass cover lens
ATEVK-MXT799TAT	MXT799T-A	798	17X x 45Y	9 inches (8:3), ITO G2, 1.1 mm glass cover lens
ATEVK-MXT1189TAT	MXT1189T-A	1189	25X x 45Y	10 inches (16:9), ITO G2, 1.1 mm glass cover lens
ATEVK-MXT1665AT	MXT1665T-A	1665	30X x 52Y	12 inches (8:3), ITO G2, 1.1 mm glass cover lens
ATEVK-MXT144U	MXT144U-M	144	–	2.2 inches Touchpad, PCB sensor
ATEVK-MXT336U	MXT336U-C	336	–	4.5 inches (xx), ITO G2, 0.55 mm glass cover lens
ATEVK-MXT640U	MXT640U-C	640	–	5.9 inches (xx), ITO G2, 0.55 mm glass cover lens
ATEVK-MX1664T	MXT1066T MXT1664T	1066	–	8.3 inches (16:9), ITO G2, 0.55 mm glass cover lens
ATEVK-MXT2952T2	MXT2952T2	2952	–	13.3 inches (16:9), ITO G2, 0.55 mm glass cover lens

maXTouch Studio Development System

maXTouch Studio is the Integrated Development Platform (IDP) for developing and debugging with Microchip's maXTouch products. This development tool supports the whole product portfolio of our industrial and automotive touchscreen controllers and is used in combination with the above evaluation kits and/or with your touch system.

Key Features of MaxTouch Studio

- Communication to all devices for read, write and debug functions
- Different levels of access to tools
- Ability for you to create and update tools
- Remotely share of projects/files between users
- Device firmware upgrade capability
- Automatic links for device and datasheet/protocol guide
- Android utility support
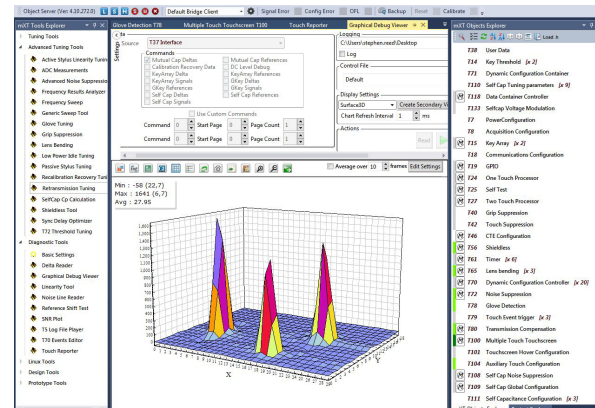
GestIC—3D Gesture Evaluations Kits

GestIC Evaluation Kits enable to experience the benefits of gesture based user interaction out of the box while at the same the the modular design allows implementation into your product designs. All Kits support our Aurea Visualization SW suite.

Please find all details at www.microchip.com/gestic.
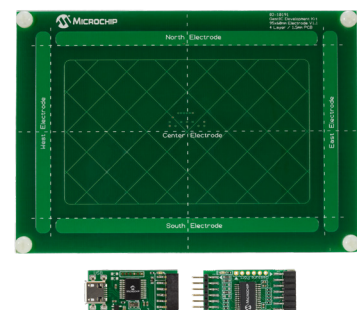
Support

Microchip is committed to supporting its customers in developing products faster and more efficiently. We maintain a worldwide network of field applications engineers and technical support ready to provide product and system assistance. For more information, please visit www.microchip.com:

- Technical Support: www.microchip.com/support
- Evaluation samples of any Microchip device: www.microchip.com/sample
- Knowledge base and peer help: www.microchip.com/forums
- Sales and Global Distribution: www.microchip.com/sales

Training

If additional training interests you, Microchip offers several resources including in-depth technical training and reference material, self-paced tutorials and significant online resources.

- Overview of Technical Training Resources: www.microchip.com/training
- MASTERs Conferences: www.microchip.com/masters
- Developer Help Website: www.microchip.com/developerhelp
- Technical Training Centers: www.microchip.com/seminars

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