MICROCHIP

Touch and 3D Gesture Control

www.microchip.com/touch

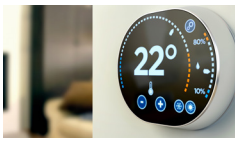
Touch and Gesture

Welcome to the powerhouse of touch. Microchip offers a compelling capacitive touch solution for every touch use case – from single buttons to touchpads and touchscreens to proximity detection and 3D gesture control for the consumer, industrial and automotive market.

Microchip's touch solutions excel based on our deep knowledge and experience. Regardless of whether you choose a touch turnkey product or a touch library for a microcontroller, you always benefit from decades of touch experience.

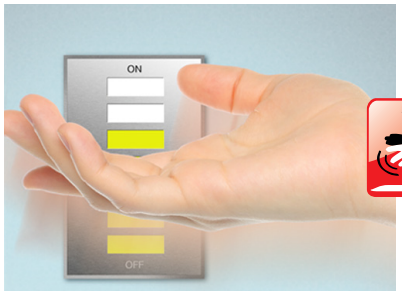
Proximity, Button Slider, Wheels

- Turnkey Touch CAP/AT42QT/MTCH
- Touch Libraries PIC®/AVR®/SAM MCUs



Touchpads/ Touchscreens

- Multi Touch Screens maXTouch® Technology
- 2D Touch Surface Library PIC/AVR/SAM MCUs



Free Space Gesture Control

- 3D Gesture GestIC® Technology

All technologies behind our touch solutions are developed in house.

Technologies

- Adaptive noise filtering
- Water-tolerant touch buttons, sliders and wheels
- Water-tolerant touchpads and -screens
- Hardware touch measurement peripherals (CIPs) on microcontrollers
- Driven shield for increased sensitivity, noise shielding and water tolerance
- PCB track length compensation
- Low-power wake-up on touch
- Mutual capacitive sensing
- Self-capacitance sensing
- Autonomous touch sensing
- Parallel sensing
- Auto calibration

Use Cases

- Buttons
- Sliders
- Wheels
- Proximity
- Hands-on detection
- Lowest power touch pads
- Touchscreens
- Touchpads with gesture detection
- Keyless entry door handle
- Appliance safety touch
- Automotive functional safety touch
- 3D gesture sensing

www.microchip.com/touch
www.microchipdeveloper.com/touch:start

Why Capacitive Touch?

From your customers perspective, the user interface is the product.

Innovative, modern and attractive. In short, high-selling products all have one thing in common—they all have a user-friendly interface.

Adding touch to your product adds value to your product. Interfaces with mechanical push buttons have several moving parts, significantly decreasing reliability and tooling cost.

Why Touch With Microchip?

With over a decade of experience in automotive touch, Microchip is the leading provider of robust touch solutions. Furthermore, our touch tool chain ensures that your touch journey is as short as possible, minimizing time to production. Microchip is also aware that you operate globally. We will provide on-site, native language support in your design centers as well as at your manufacturing locations. We call it local support on a global scale.

Turnkey Touch Products

Turnkey touch controllers provide the fastest and easiest way to upgrade from mechanical buttons to modern touch buttons or displays with touch. Our turnkey touch products are ready to use for implementation of touch buttons, sliders and wheels, touchscreens and proximity solutions for consumer, industrial and automotive applications. No programming experience is needed, just connect the sensor and apply power. All touch controllers communicate to the host via standard serial interfaces, such as I^2C, SPI or USB as well as GPIO.

Microcontroller With 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 enable high-performance touch with dedicated on-chip touch Core Independent Peripherals (CIPs).

Microchip's touch library is supported by all of Microchip's code configurators, 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, MPLAB Harmony 3 and Atmel START.

Implementing touch on an MCU has never been easier!

MPLAB® HARMONY START

MPLAB® CODE CONFIGURATOR

Data Visualizer

maXTouch® Studio

Microchip's Performance Advantage

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

Noise Robust Touch

- IEC 61000-4-6
- Conducted noise
- Radiated noise
- ESD
- BCI tests
- Emission/CISPR-25

Automotive Touch

- Automotive touch screens
- Automotive touch MCUs
- Automotive Design Center
- Functional Safety Design Center

Home Appliance Safety

- IEC60730 certified solutions
- Touch library for MCUs
- Touch Turnkey products

True Water Tolerant Touch

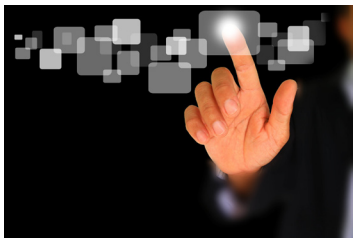
- Outdoor use, rain tolerant
  - No lock-out – touch remains functional
  - Buttons, sliders, touchpads, touchscreens
- Waterproof touch with Metal Over Cap (MoC)

Long-Term Touch Provider

- 20+ years experience in touch
- Serving all use touch use cases
- Risk mitigation by choosing an established solution

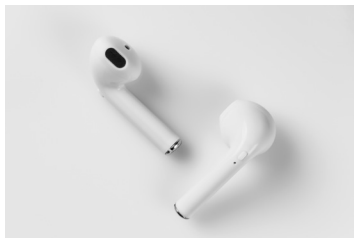
Ease-of-Use

- Local (language) support on global scale
- Fast development with code configurators
- microchipdeveloper.com, your touch solution center



Very-High Button Count

- Dedicated solution to enable noise robust and fast touch
- Cost down due to reduced chip count
- Support for long feeding lines

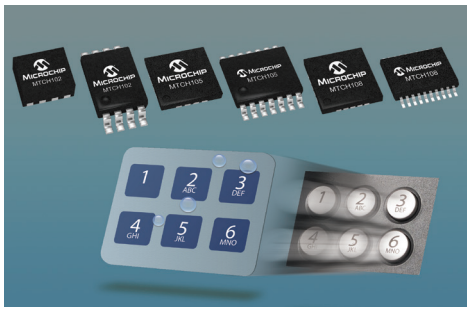


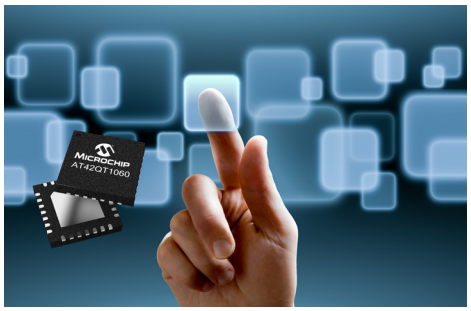
Low Power

- Low power flat rate < 5 µA
- Power consumption doesn't scale with button count

Turnkey Touch Products

Our turnkey touch products pave a straight path for you to implement touch in your user interface. The 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, turnkey touch products offer the shortest time to market - ideal for your first touch design. 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

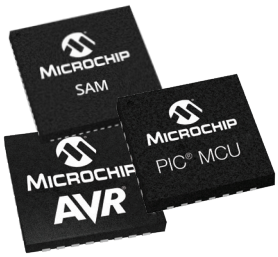
- 3 to 14 sensing channels
- I²C interface
- Water-tolerant touch
- LED driver—high resolution PWM

AT42QTxxxx

- 1 to 64 sensing channels
- UART/SPI/I²C interface
- EN/IEC 60730 certification on select devices

Touch on Microcontrollers – Microchip's Touch Libraries

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



Benefits of MCUs With Touch

Our MCUs feature dedicated CIPs to offload touch functionality from the MCU core.

- Hardware Capacitive Voltage Divider (HCVD)
- ADC with Computation (ADCC)
- Peripheral Touch Controller (PTC)

These touch modules support self- and mutual-capacitance measurements, providing you with great flexibility. Due to their 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 in harsh environments.

- 8-, 16- and 32-bit platforms
- Smallest packages include WLCP
- Cost-opttimized production with SOIC/SSOP
- From 6-pin to 144-pin devices, up to 1 MB Flash memory
- On-chip integration options include USB, CAN, FD, LIN, IrDA®, wireless protocol stack, segmented LCD and graphics
- Automotive certified MCUs in 8/16/32-bit

Touch Development Tools

Microchip supports touch configuration right from the Integrated Development Environment (IDE). You can configure your touch design easily and the IDE generates ready-to-use code - tailored to your design.

- MPLAB X IDE features MPLAB Code Configurator (MCC) for 8-bit PIC devices
- MPLAB X IDE features Harmony 3 for 32-bit SAM/PIC32 devices
- 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

The Data Visualizer connects directly to your application and allows real-time analysis of touch signals for quick touch tuning to optimal performance.

MPLAB CODE CONFIGURATOR MPLAB HARMONY START Data Visualizer

2D Touch Sensing – Touchpads and Touchscreens

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

Our 2D touch library focuses on lowest power touchpads, high level of microcontoller integration and on-chip surface gesture detection (swipes, taps, pinch/zoom)—features needed in wireless headphones, ear buds, remote controls or small touchpads on for example steering wheels.

2D Touch Library – Touchpads on MCU

A microcontoller is a highly integrated, single chip solution for smaller touchpads and touchscreens. The key element is the cost efficient integration of the user interface into the main controller of your device. Instead of a dedicated touch controller your (already existing) main MCU running the 2D touch library from Microchip that function. Our 2D touch surface libraries are available for 8-bit PIC and AVR microcontoller as well as 32-bit SAM microcontollers; three low-power and cost-efficient platforms.

2D Touch for Embedded Devices

Customers these days expect a “smartphone-like” user interface on many products including wearable/IoT devices, remote controls, audio devices, in their cars and more. These expectations are paired with requirements such as 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 speakers (home assistants)
- Touchpads on steering wheels

Features

Our 2D Touch Surface Library supports 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. In addition, we provide on-chip surface gesture recognition—enabling truly intuitive user interfaces. The 2D Touch Surface Library brings phone-like user interface elements to embedded devices – without you investing into the hardware ecosystem of a phone.

Position Tracking

- Single and dual finger tracking
- Water tolerant touch
- 100 Hz+ report rate

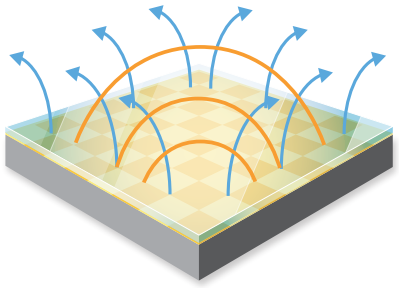
Surface Gestures

- Double tap, triple tap (single and dual finger)
- Long press (single and dual finger)
- Swipe and swipe and hold (single and dual finger)
- Rotations
- Pinch/zoom

We deliver the 2D Touch Surface Library to your project, tailored to your needs through our code configurators. Touch pad support is built into MCC, MPLAB Harmony 3 and Atmel START.

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

The maXTouch controller family provides a leading projected capacitive technology for touchscreens and touch pads. It supports single-finger, multi-finger 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"	ATMXT144U-MAU	38-pin QFN	I²C	No	No	Single- and dual-finger
	ATMXT144U-UU	36-pin WLCSP				
3–7"	ATMXT336U-MAU	56-pin QFN			Yes	No
5–10"	ATMXT640U-CCU	88-lead UFBGA		Yes		
9–12"	ATMXT1066T2-C2U	144-lead UFBGA (HDI)				
	ATMXT1066T2-NHU	117-lead UFBGA (non-HDI)				
10–16"	ATMXT1664T3-C2U	162-lead UFBGA	I²C and USB			
	ATMXT1664T3-CCU	136-lead UFBGA				
14–24"	ATMXT2952TD-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 qualified. 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	2D Gestures
1–4"	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
4–6"	ATMXT449TD-A	100-pin TQFP			
6–8"	ATMXT641TD-A	100-pin TQFP			
8–10"	ATMXT1067TD-A	128-pin TQFP			
9–11"	ATMXT1189TD-A	144-pin LQFP			
10–13"	ATMXT1665TD-A	144-pin LQFP			
13–16"	ATMXT2113TD-A	144-pin LQFP			
16–20"	ATMXT2912TD-A	176-pin LQFP			

MGC3030/3031 and MGC3140 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 MGC3140 is the first gesture controller qualified for Automotive AEC-Q100.

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.

MGC3140 for Automotive

The MGC3140 is Microchip's first Gesture controller qualified for AEC-Q100 and available from –40°C to +125°C. It meets all EMC/EMI requirements and comes in a 48-pin UQFN package

- 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 all GestICcontrollers 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.

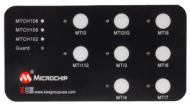
The **Presence Gesture** enables intelligent back lighting and in the simplest manner.

Position Tracking is available on the MGC3130 and 3140.

Touch Development Tools

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

Turnkey Touch Development Kits



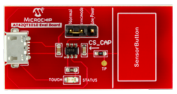
MTCH10X Evaluation Board (DM160229)

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.

AT42QT1010 Evaluation Kit (AT42QT1010)



The AT42QT1010 evaluation kit provides an easy way to evaluate and develop a variety of capacitive touch sense application using the AT42QT1010 turnkey touch device.

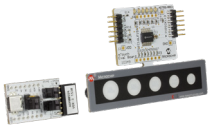
Microcontoller with Touch Development Kits

Standalone Touch Evaluation Kits

Microchip offers a series of standalone touch evaluation kits which allows you to start exploring great touch performance out of the box without any programming needed. This includes kits like the Water Tolerant Touch Surface Development kit and ATtiny817 Water Tolerance Demo kit.

Platform Evaluation Kits

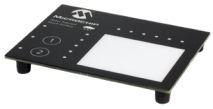
Microchip also offer an extensive collection of platform evaluation kits, like the Low Cost mTouch® Evaluation Kit, SAM L10 Xplained Pro and QT7 Xplained Pro. These kits provide a great way to develop your touch application and allows you to include other functionalities like Wi-Fi®, LIN or OLED screen into your touch design. Microchip offers these platform evaluation kits for most of our microcontrollers.



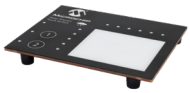
DM160227

ATTINY817-QTMOISTD

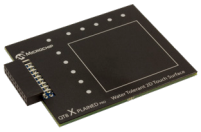
ATQT7-XPRO



DM080101 (AVR edition)



DM164149 (PIC edition)



ATQT8-XPRO

MikroElektronika Click boards™

Mikroelektronika Click boards provide an easy 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).

Cap Touch click

Cap Touch 2 click

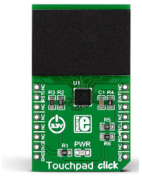
TouchKey 2 click

TouchKey 3 click

TouchKey 4 click

Cap Extend 3 click

SAML Touch Click



Touchpad click

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

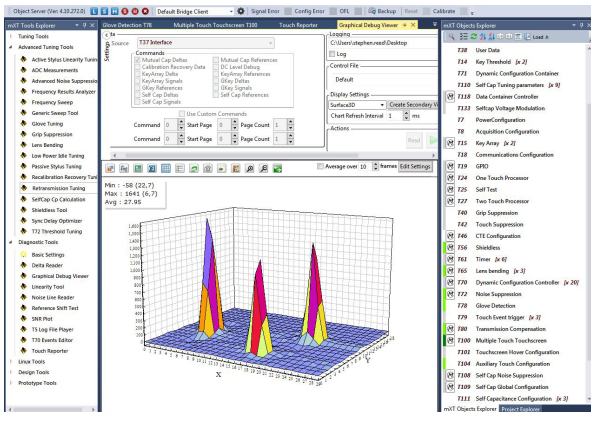
maXTouch Evaluation Kits

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	Interface	Sense Nodes	Sensor Matrix	Sensor Details
ATEVK-MXT225TDAT-A	ATMXT225TD-A	I²C	224	19X x 11Y	3.5 inch touchpad, PCB with 2mm plastic lens
ATEVK-MXT641TDAT-A	ATMXT449TD-A, ATMXT641TD-A	I²C	640	30X x 19Y	8 inch (16:9), ITO G2, 1.1mm glass cover lens
ATEVK-MXT641TDAT-B	ATMXT449TD-A, ATMXT641TD-A	SPI	640	30X x 19Y	8 inch (16:9), ITO G2, 1.1mm glass cover lens
ATEVK-MXT1067TDAT-A	ATMXT1067TD-A (I2C)	I²C	1066	41X x 26Y	8.3 inch (16:10), ITO OGS, 0.55mm glass cover lens
ATEVK-MXT1067TDAT-C	ATMXT1067TD-A (SPI)	SPI	1066	41X x 26Y	8.3 inch (16:10), ITO OGS, 0.55mm glass cover lens
ATEVK-MXT1189TDAT-A	ATMXT1189TD-A	I²C	1188	25X x 45Y	10 inch (16:9), ITO G2, 1.1mm glass cover lens
ATEVK-MXT1189TDAT-C	ATMXT1189TD-A	SPI	1188	25X x 45Y	10 inch (16:9), ITO G2, 1.1mm glass cover lens
ATEVK-MXT1665TDAT-A	ATMXT1665TD-A	I²C	1664	30X x 52Y	12 inch (16:9), ITO G2, 1.1mm glass cover lens
ATEVK-MXT1665TDAT-C	ATMXT1665TD-A	SPI	1664	30X x 52Y	12 inch (16:9), ITO G2, 1.1mm glass cover lens
ATEVK-MXT2113TDAT-A	ATMXT2113TD-A	I²C	2112	32X x 64Y	13.3 inch (16:9) ITO OGS, 1.1mm glass cover lens
ATEVK-MXT2113TDAT-B	ATMXT2113TD-A	SPI	2112	32X x 64Y	13.3 inch (16:9) ITO OGS, 1.1mm glass cover lens
ATEVK-MXT2912TDAT-A	ATMXT2912TD-A	I²C	2911	41X x 71Y	15.6 inch (16:9) ITO OGS, 1.1mm glass cover lens
ATEVK-MXT2912TDAT-B	ATMXT2912TD-A	SPI	2911	41X x 71Y	15.6 inch (16:9) ITO OGS, 1.1mm glass cover lens
ATEVK-MXT144U-A	ATMXT144U-MAU	I²C	144	12X x 12Y	2.2 inch touchpad, PCB sensor
ATEVK-MXT336U-A	ATMXT336U-MAU	I²C	336	14X x 24Y	4.5 inch, ITO G2. 0.55mm glass cover lens
ATEVK-MXT640U-A	ATMXT640U-CCU	I²C	640	32X x 20Y	5.9 inch, ITO G2. 0.55mm glass cover lens
ATEVK-MXT1066T2-A	ATMXT1066T2-C2U	I²C	1066	41X x 26Y	8.3 inch (16:10), ITO OGS, 0.55mm glass cover lens
ATEVK-MXT1664T3-A	ATMXT1664T3-CCU	USB	1664	32X x 52Y	10.1 inch (16:10), ITO OGS, 0.55mm glass cover lens
ATEVK-MXT2952TD-A	ATMXT2952TD-C2U	USB	2911	41X x 71Y	15.6 inch (16:9) ITO OGS, 1.1mm 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
- Remote sharing of projects/files between users
- Device firmware upgrade capability
- Automatic links for device datasheets and protocol guides
- Android utility support

GestIC Technology—3D Gesture Evaluations Kits

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

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