MICROCHIP

Touch and 3D Gesture Control

www.microchip.com/touch

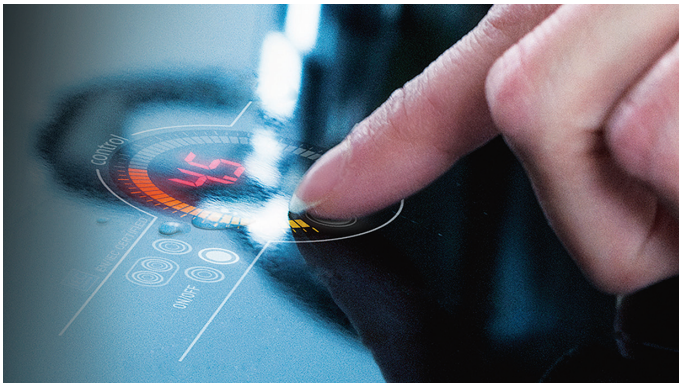
Microchip's award winning technologies cover a broad range of implementations for touch and gesture controlled applications—from touch buttons (1D) to touch screens (2D), as well as 3D gesture control. Microchip will cover your application, including:

- Water-tolerant touch buttons
- Heavy duty touch solutions under metal
- Lower-power touch pads
- Multi-touch screens and pads with maXTouch® technology
- Non-touch interaction based on hand gestures
- Cost-efficient 8-bit AVR® and PIC® MCU-based touch solutions with integrated touch peripheral
- High-performance 32-bit touch solutions with integrated touch peripheral (SAM_D/L series)
- IEC/UL 60730 Class-B certified touch solutions

Buttons, Sliders, Wheels and Proximity

User interfaces with push buttons have several moving parts, which significantly decrease their reliability. They also require complex design and assembly as well as a major investment in tooling. Microchip touch technologies allow you to create a high-impact user interface at a lower total system cost.

- Easy to use
  - Turnkey, bus or digital I/O interface
  - Microcontroller based with touch library
- Robust
  - High SNR (Signal to Noise Ratio)
  - IEC61000, EFT and BCI tested
  - IEC/UL 60730 Safety Class-B supported
- Lowest Power
  - Proximity sensing down to 1 µA
  - Water-tolerant touch
  - Capacitive Sensing down to 5 µA



Capacitive Touch Sensing

Turnkey Solutions

The **MTCH10x** capacitive touch controllers provide the fastest and simplest way to evolve from mechanical buttons to modern touch. Designed for direct button replacement, the MTCH10x family provides dedicated digital output for every input channel while implementing latest noise suppression technologies.

- From 1 to 8 sensors
- Water resistance
- Proximity
- Packaging as small as 2 × 3 mm UDFN

The **CAP1xxx** and **AT42QTxxxx** capacitive touch controllers provide a wide variety of slider, button and proximity functionality. A Graphical User Interface (GUI) allows the designer to analyze sensor data and easily configure the controller.

CAP1XXX

- 1 to 14 sensors, up to 11 LED drivers
- Enhanced proximity option with guard ring
- I²C and SPI communication
- 3.0–5.5V
- As small as 2 × 3 mm TDFN or optimized as SOIC

AT42QTXXXX

- 1 to 64 sensors (up to 8 × 8 matrix)
- Automotive supported
- I²C, SPI, UART and GPIO communication
- 1.8–5.5V

mTouch and QTouch Libraries

Every platform has touch built into the IDE. PIC MCUs are supported by MPLAB® X IDE, and the touch library is configured to your needs by using the MPLAB Code Configurator (MCC). Atmel Studio 7 supports both AVR and SAM MCUs along with the QTouch Composer. Cloud-based development is also available with MPLAB Xpress and Atmel START. In any case, the provided touch libraries allow you to focus on your main application, and benefit from Microchip's experience in touch technology.

Microcontroller-Based Solutions

Microchip offers complete tools to enable touch sensing on any MCU with an ADC. By using an MCU with an integrated touch module, the highest integration and lowest power can be achieved. Three touch modules are available:

- Hardware Capacitive Voltage Divider (HCVD) for PIC MCUs
- ADC with Computation and HCVD for PIC MCUs
- Peripheral Touch Controller (PTC) for AVR/SAM MCUs

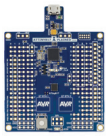
Other features of our MCU-based solutions include:

- 8-, 16- and 32-bit **PIC**, **AVR** and **SAM** MCUs for touch sensing
- **mTouch**® (PIC MCUs) and **QTouch**® (AVR/SAM MCUs) libraries
- From 6-pin to 144-pin devices, up to 512 KB Flash memory
- On-chip integration options include USB, CAN, IrDA, wireless protocol stack, segmented LCD and graphics accelerator and LCD driver for TFT/STN displays

Development Tools

QTouch Evaluation Kits

QTouch Evaluation Kits such as the ATtiny817 Xplained Mini (ATTINY817-XMINI) or 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.



Low-Cost mTouch Evaluation Kit (DM160227)

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

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.

Water-Tolerant Touch

A key feature that Microchip has embedded into the touch modules is the support of water-tolerant touch. As touch interfaces are being offered in a growing number of products and applications, user expectations are evolving as well. Users expect their touch interfaces to work well in a range of conditions without the need to clean their hands or wipe them dry every time they use their devices. Users also do not want to be hindered from interacting with their devices if the surface is wet.

To meet these user expectation, the latest generation of touch modules (PTC/HCVD/ADC2 with HVCD) generates guard signals (driven shield) to make the short circuits caused by moisture invisible to the touch MCU. Microchip offers hardware-based, water-tolerant touch. The ATtiny81x and PIC16LF156x series of MCUs. This technologies goes way beyond water-tolerant buttons and also offers water-tolerant touch pads.

For datasheets, user's guides and general design information please visit www.microchip.com/touch.

Touch Through Metal

In addition to capacitive touch, Microchip has developed metal-over-capacitive technology enabling:

- Metal surfaces such as stainless steel or aluminum
- Sense through glove support
- Waterproof designs
- Braille-friendly interfaces

Metal-over-capacitive technology is implemented with the same Microchip hardware, PCB, electronics and firmware as capacitive touch technology and is compatible with all touch products.

2D Solutions

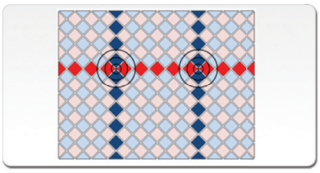
Projected Capacitive Technology

Microchip's projected capacitive technology is available as turnkey touch controllers (maXTouch technology) or solutions across the portfolio of 8- and 32-bit MCUs. A touch surface library is available for ease of use.

How It Works

Projected Capacitive Touch Sensors operate by measuring the tiny change in capacitance on an electrode due to the influence of a human finger or other object.

- One or two thin conductive layers
- Pad/screen is configured as rows and columns
- Point of contact identified by change in capacitance of row and column cells electrodes



Small and Low-Power w Solutions for Embedded Applications

Included Gestures

The MTCH6102 detects finger gestures on chip, elevating the user interface of embedded devices. Without an operating system, convenient features such as swipes are not available or can demand valuable host resources. The on-board gestures increase usability while saving power resources.

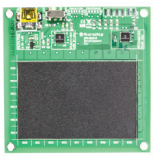
Single Tap
Double Tap
Tap and Hold
Swipe Up
Swipe Up and Hold
Swipe Down
Swipe Down and Hold
Swipe Left
Swipe Left and Hold
Swipe Right
Swipe Right and Hold

QTouch Surface Library

For ATSAMD/L/C devices, Microchip offers the QTouch Surface Library to enable fast and reliable touch pad implementations. The library leverages the PTC, minimizing the core resources so that these are available for your main application. The use of the QTouch Surface Library is as simple and easy to use as the original QTouch Library for touch buttons, fully supported by Atmel Studio 7.

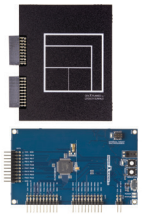
Development Tools

Microchip makes it easy to add gestures and multi-touch to your interface design.



MTCH6102 Development Kit (DM160219)

- Supports the MTCH6102
- Surface gesture detection on board
- GUI with skins to accelerate UI development

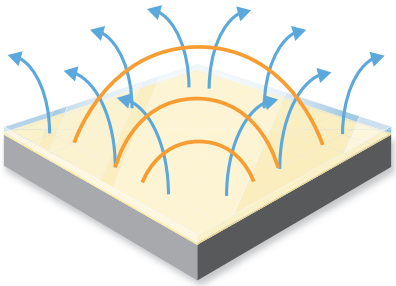


QTouch Surface Tools

- SAM D20 Xplained Pro (ATSAMD20-XPRO)
- QT6 Xplained Pro (ATQT6-XPRO)
- Dual-finger touch pad with built-in visualization

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 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	Gestures
1–4"	ATMXT336S-A	64-pin TQFP	I²C	Grade 3	Single- and dual-finger gestures
	ATMXT225T-A	100-pin TQFP	I²C and SPI	Grade 3 (–40 to +85°C) Grade 2 (–40 to +105°C)	
4–5"	ATMXT449T-A	100-pin TQFP			
6–7"	ATMXT641T-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 (I^2C) 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.

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:

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If additional training interests you, then Microchip can help. We continue to expand our technical training options, offering a growing list of courses and in-depth curriculum locally, as well as significant online resources.

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