



Touch sensing overview



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A quality version of this page, approved on 29 September 2021, was based off this revision.

This page contains application examples, document references, tips and tricks and so on related to STM32 touch sensing.

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1 What is touch sensing?

Touch sensors are used in HMIs (human-machine interfaces)

Instead of using mechanical switches, actuation is achieved by touching the finger touch on a surface.

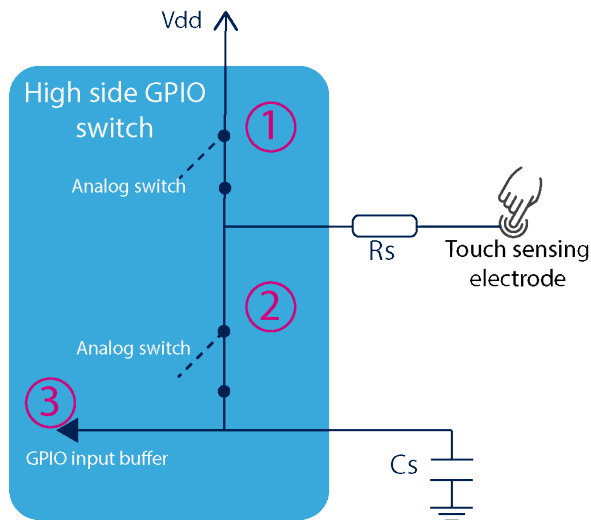
There are three methods:

- **Capacitance switch:**
 - the electrode is placed behind a non-conductive panel
 - the change in capacitance is detected
- **Resistive touch switch:**
 - two electrodes are bridged by the user's fingertip
 - the resistance of the fingertip is detected
- **Piezo touch switch:**
 - a voltage is generated by pushing/bending a piezoelectric material
 - the voltage change is detected

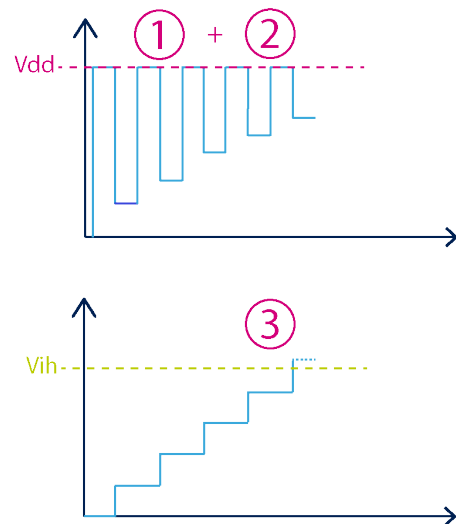
The TSC (touch sense controller) peripheral is based on the capacitance switch method - when a human touches the surface of the sensor area, the capacitance changes.

Basic TSC working mode description

Acquisition principle



Waveforms



Touch sensing electrode: ~10pF
 Cs sampling capacitor: ~22-200nF (typical)
 Rs sensor resistor: 10KOhm (typical)



2 Getting started with STM32 and touch sensing

Application note AN5105 summarizes all information regarding touch-sense controller usage.

This application note explain step-by-step how to handle touch sensors using STM32F072BDISCO^[1] and STM32L0538DISCO^[2] discovery boards^[3].



3 STM32 compliance with touch sensing

3.1 Maximum number of sensors on STM32 Series products

| | STM32L 0 | STM32L1 | STM32L 4 | STM32L4 + | STM32L 5 | STM32F 0 | STM32F 3 | STM32W B |
|---------------------|-------------|-----------------|-------------|--------------|-------------|-------------|-------------|-------------|
| Peripheral | TSC | Software assist | TSC | TSC | TSC | TSC | TSC | TSC |
| Groups | 8 | 11 | 8 | 8 | 8 | 8 | 8 | 7 |
| Channels | 32 | 48 | 32 | 32 | 30 | 32 | 32 | 28 |
| Sampling capacitors | 8 | 11 | 8 | 8 | 8 | 8 | 8 | 7 |
| Sensors | 24 | 37 | 24 | 24 | 22 | 24 | 24 | 21 |

3.2 Maximum number of sensors on LQFP64 packages

| | STM32L 0 | STM32L1 | STM32L 4 | STM32L 5 | STM32F 0 | STM32F 3 |
|---------------------|-------------|-----------------|-------------|-------------|-------------|-------------|
| Peripheral | TSC | Software assist | TSC | TSC | TSC | TSC |
| Groups | 8 | 10 | 4 | 8 | 6 | 6 |
| Channels | 32 | 33 | 16 | 30 | 24 | 24 |
| Sampling capacitors | 8 | 10 | 4 | 8 | 6 | 6 |
| Sensors | 24 | 23 | 12 | 22 | 18 | 18 |



4 STMicroelectronics resources

AN5105 Getting Started with Touch control

UM1913 Developing applications on STM32Cube with STMTouch touch sensing library

AN4316 Tuning a STMTouch-based application

AN4312 Guidelines for designing touch sensing applications with surface sensors

AN4299 Guidelines to improve conducted noise robustness on STM32 series touch sensing applications

AN4310 Sampling capacitor selection guide for MCU based touch sensing applications

AN3960 ESD considerations for touch sensing applications



5 References

- STM32F072BDISCO
- STM32L0538DISCO
- STM32 Discovery Kits