Table of contents

- Generic benefits of Capacitive Touch Sensing
- The Relaxation Oscillator Topology
- Dedicated functional unit for Touch Sense and LED-Matrix control
- High current ports
Generic benefits of Capacitive Touch Sensing

- Capacitive sensing is an attractive switch option
- At the heart of any capacitive-sensing system is a set of conductors which interact with electric fields. The human body varies the capacitance of this system
- The Touch Pad Controller measures the capacitance of these touch pads
- Benefits of Touch Sense Buttons
  - More reliable than mechanical counterpart – no wear out
  - Decreased bill of material
  - Best suited for flat control panels
  - Flexibility in touch pad design – button, slider, dial
Table of contents

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Initially, the discharge switch is open, and the pull-up resistor charges the sensor pad.

The voltage on the sensor pad ramps positively until it exceeds the comparator's threshold.

The comparator's output transitions from low to high, causing the discharge switch S to close.

The sensor pad quickly discharges through this low impedance path to ground.

The process causes the comparator's output to transition from high to low, and the cycle repeats.

The output frequency \( f_{out} \) is dependent on the charging current and capacitive sensor value.
Table of contents

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- High current ports
A dedicated functional unit for advanced touch control

Functional blocks of the XC82x and XC83x MCU Series supporting advanced touch sense control

Dedicated functional unit featuring:
- Touch Sense Controller
- Time multiplexing and LED-Matrix Controller
- External or internal pull-up resistor
- Automatic pad select logic for auto scan function
- Adjustable discharge time
- Adjustable saturation/overflow behavior of oscillation pulse counter
- Counter value evaluation in interrupt service routine
■ Touch Sense Signal Conditioning
  □ Adjustable Accumulation
  □ Glitch Filter
  □ Adaptive Average Control

■ Touch Sense State Machine
  □ Pad-Down and Pad-Up Handling
  □ Result and Error Handling
Time multiplexed operation of touch sensing and LED-Matrix control

Timing diagram for time multiplexed operation of touch sensing and LED-Matrix

- LED-Matrix Controller and Touch Sense Controller can share the same pins
- The time multiplexed operation is controlled by the LED and Touch Sense Unit
An LED-Matrix consists of many LEDs which are arranged in lines and columns.

A resistor in the line path limits the current.

The columns are activated one after another (multiplexing).

The line signals must be synchronized to the column activation.

The LEDs can be arranged in various layouts.
LED-Matrix Controller Details
The LED-Matrix and Touch Sense Library is the software counterpart for LED/TS hardware unit.

LED-Matrix supports up to 8x8 LEDs.

Touch Sense Evaluation Support:
- Glitch Filter
- Adaptive Average Control
- Pad-Down and Pad-Up Handling
- Result and Error Handling

Easy to use library functions will be called in interrupt service routines of LED/TS unit.
Table of contents

- Generic benefits of Capacitive Touch Sensing
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High current ports up to 50 mA

- **P1.0...P1.3**
  - direct drive of stepper gauges 30mA
  - Sink current up to 50mA
  - over current detection
  - slew rate control for optimized EMC behavior

- **P1.4...P1.5**
  - Sink current up to 50mA
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