Advanced touch sense control from Infineon – a technical introduction

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Table of contents

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

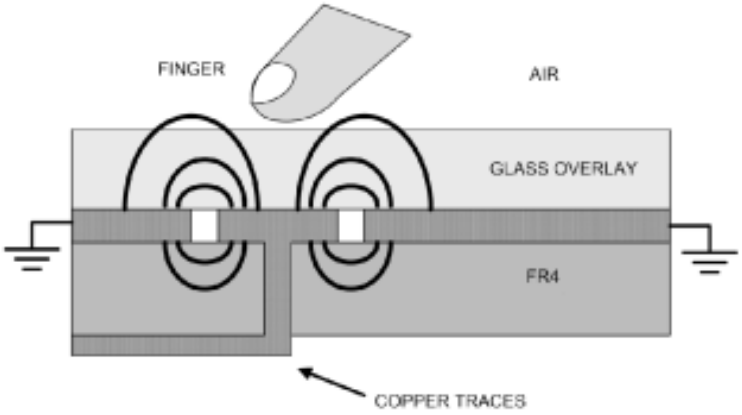
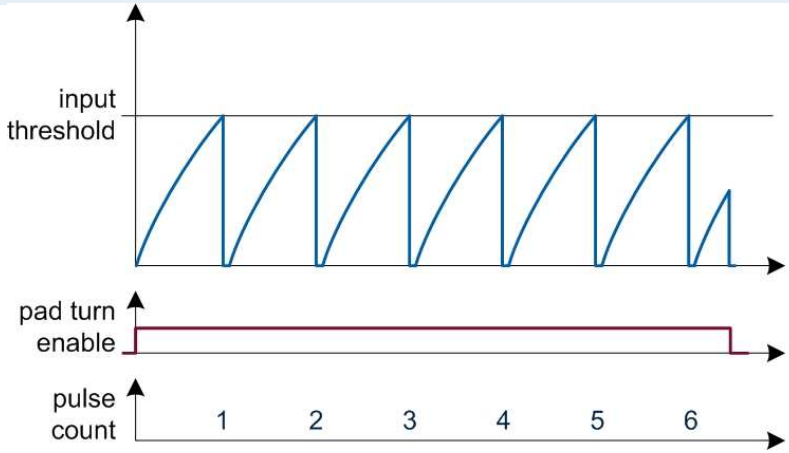
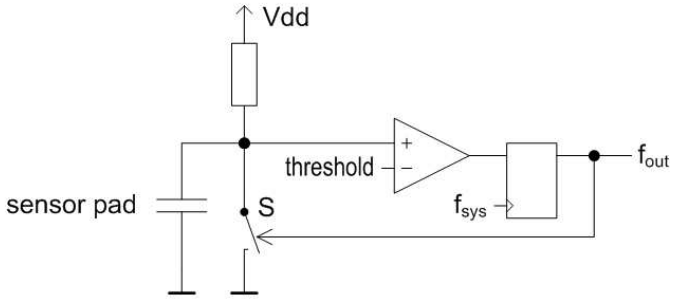


Table of contents

Capacitive Touch Sensing with the Relaxation Oscillator Topology



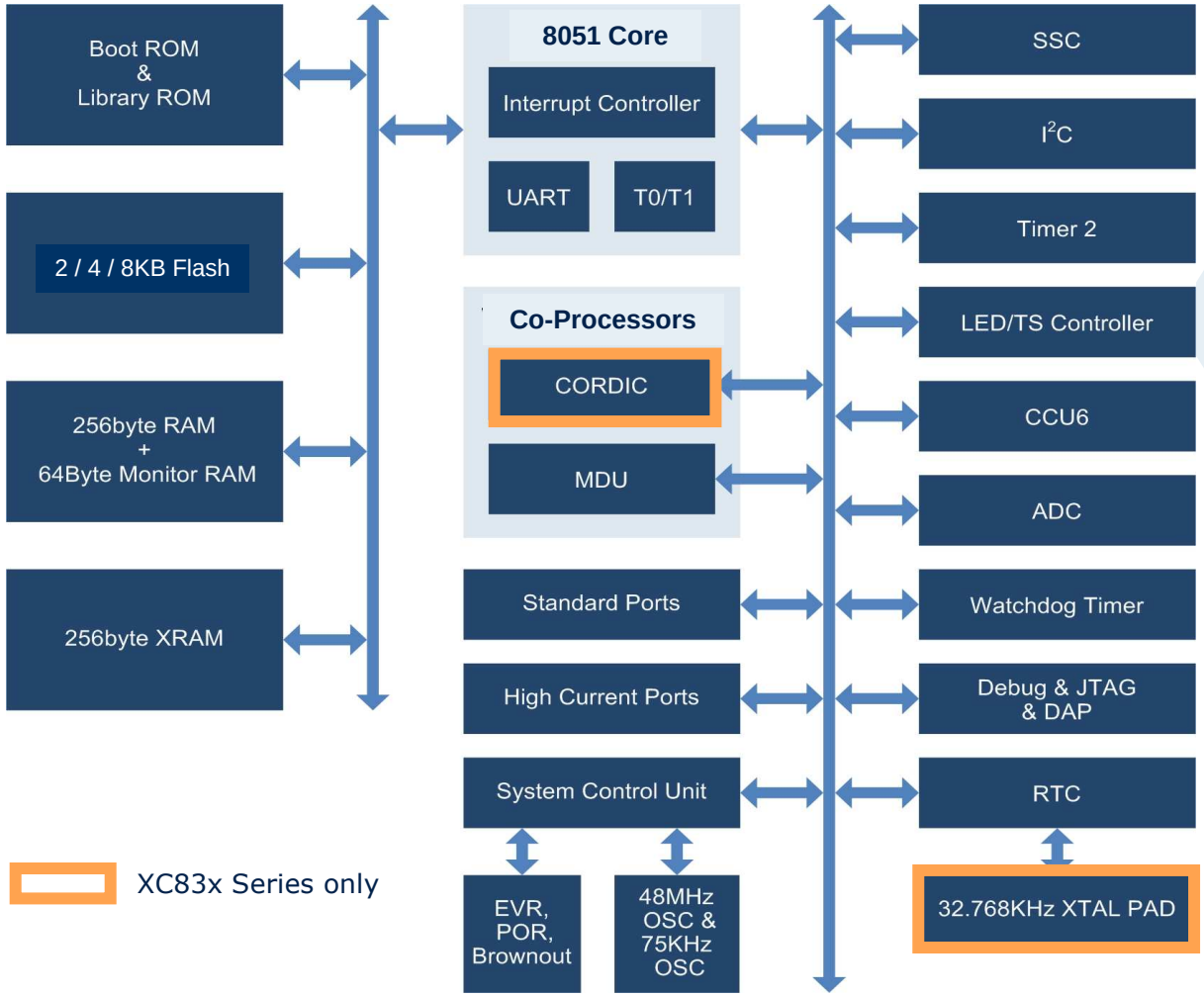


- Initially, the discharge switch is open, and the pull-up resistor charges the sensor pad.
- The voltage on the sensor pad ramps positively until it exceeds the comparator's threshold.
- The comparator's output transitions from low to high, causing the discharge switch S to close.
- The sensor pad quickly 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

A dedicated functional unit for advanced touch control

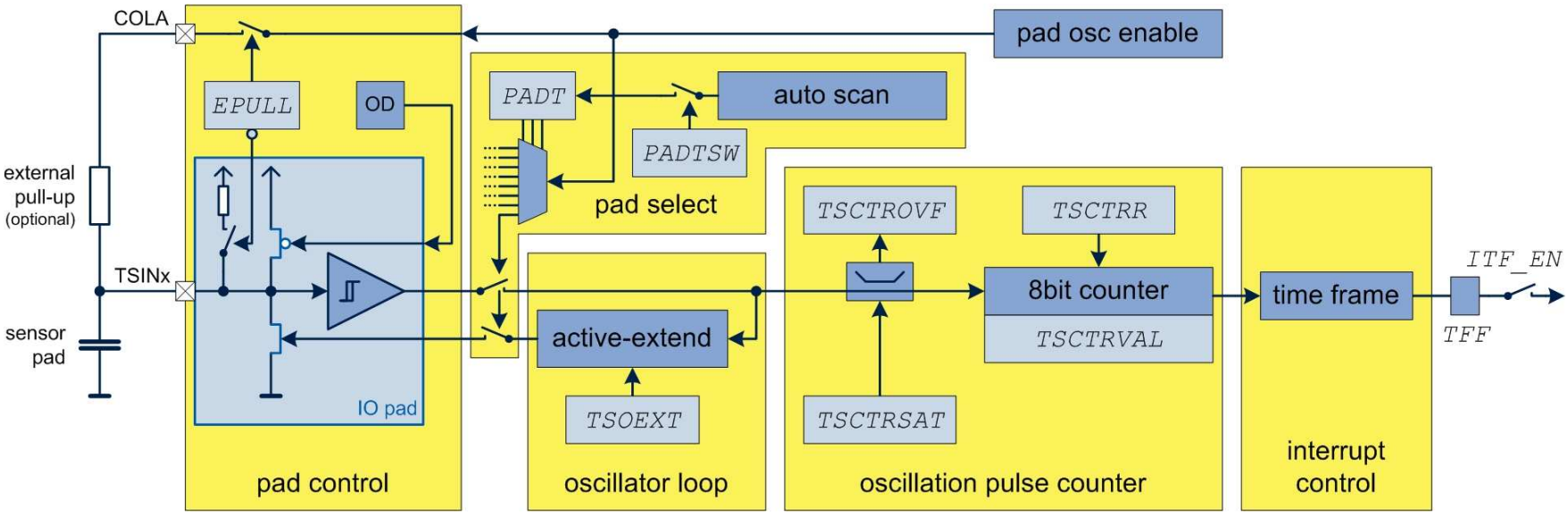
Functional blocks of the XC82x and XC83x MCU Series supporting advanced touch sense control



Dedicated functional unit featuring:

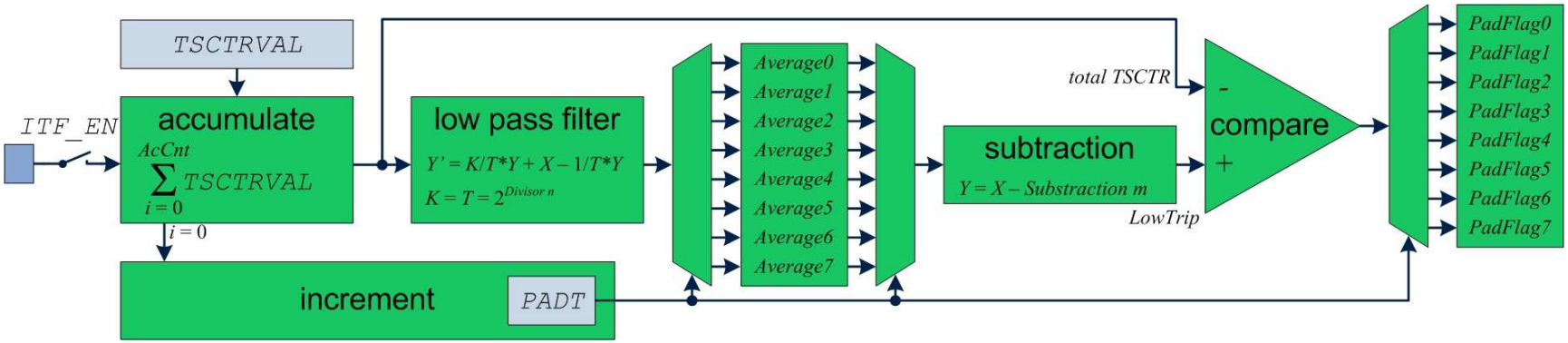
- **Touch Sense Controller**
- Time multiplexing and **LED-Matrix Controller**

Touch Sense Controller Features

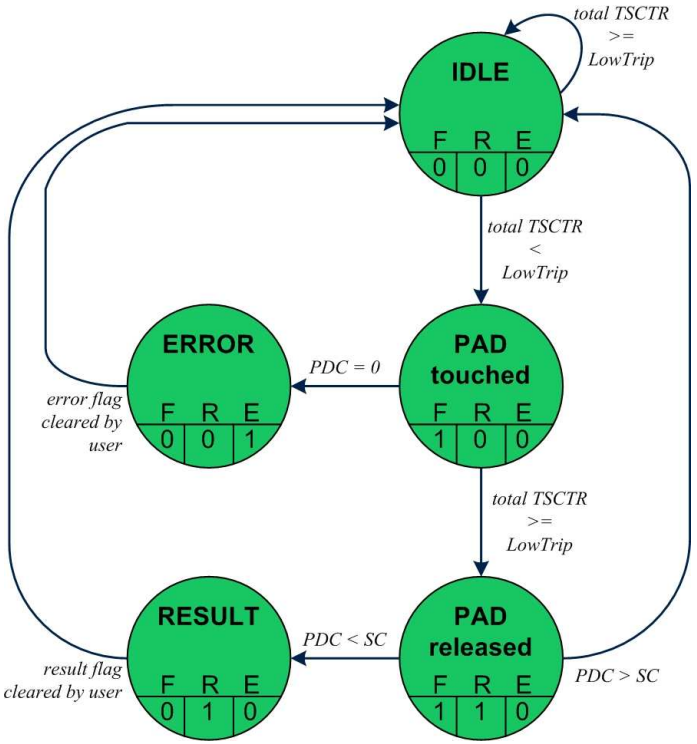


- External or internal pull-up resistor
- Automatic pad select logic for auto scan function
- Adjustable discharge time
- Adjustable saturation/overflow behavior of oscillation pulse counter
- Counter value evaluation in interrupt service routine

Touch Sense Controller Software in ROM Library

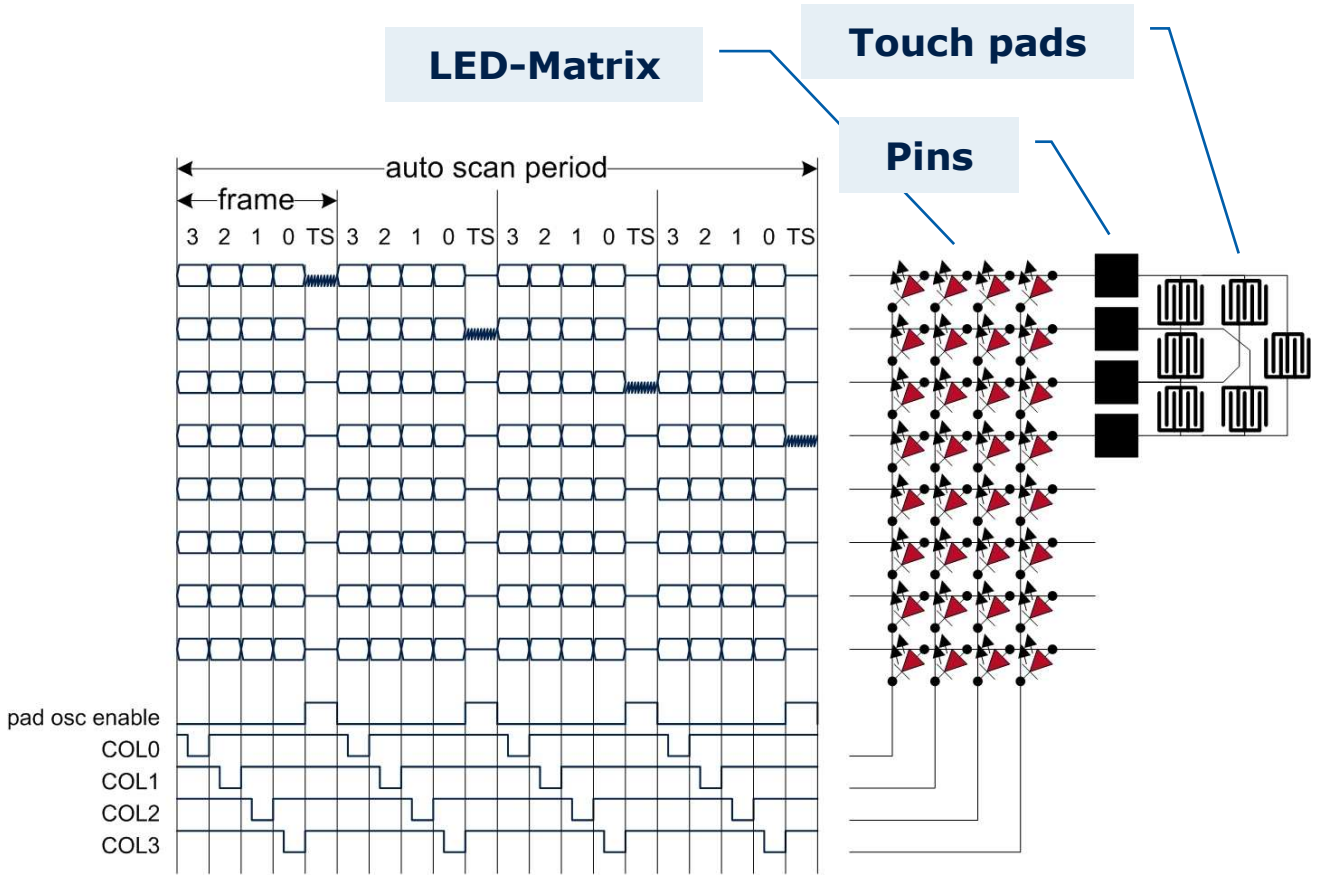


- Touch Sense Signal Conditioning
  - Adjustable Accumulation
  - Glitch Filter
  - Adaptive Average Control
- Touch Sense State Machine
  - Pad-Down and Pad-Up Handling
  - Result and Error Handling



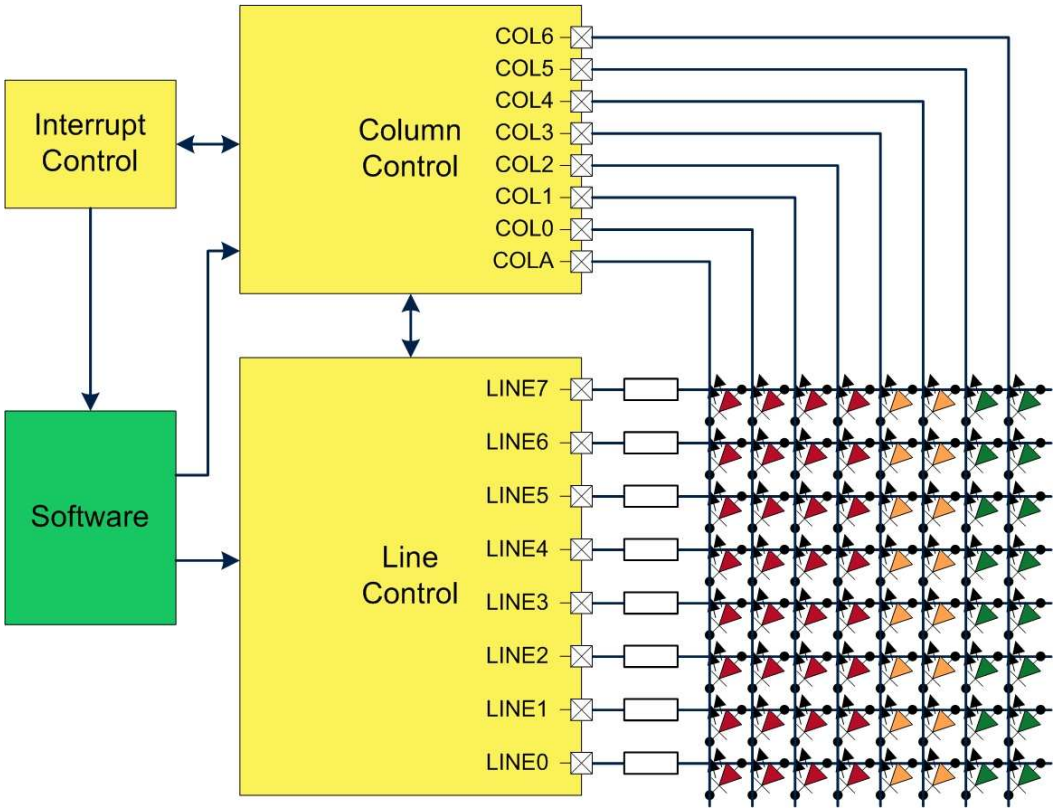
Time multiplexed operation of touch sensing and LED-Matrix control

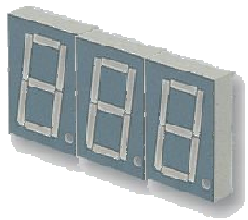
Timing diagram for time multiplexed operation of touch sensing and LED-Matrix



- 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

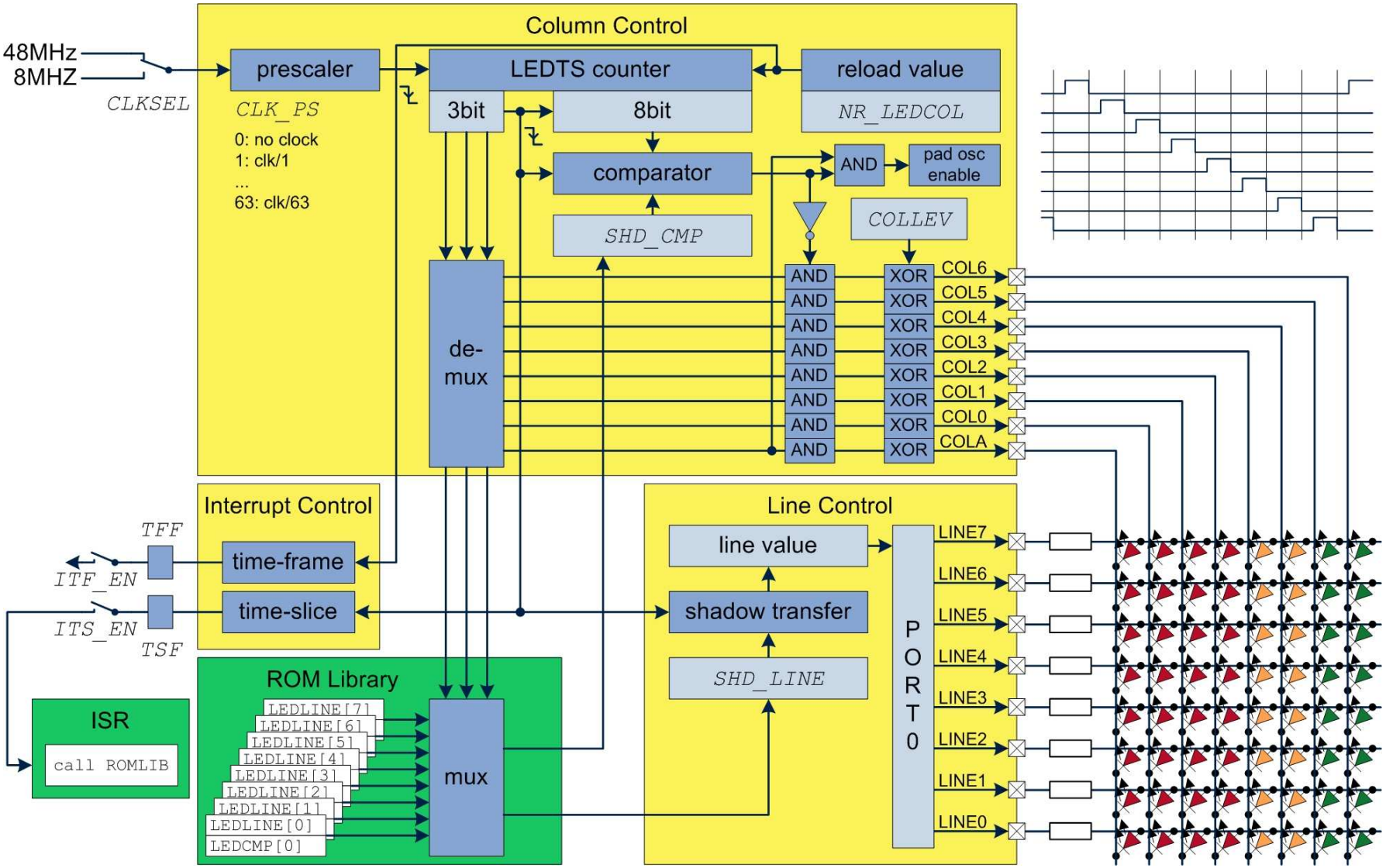
LED-Matrix Controller Overview





- 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

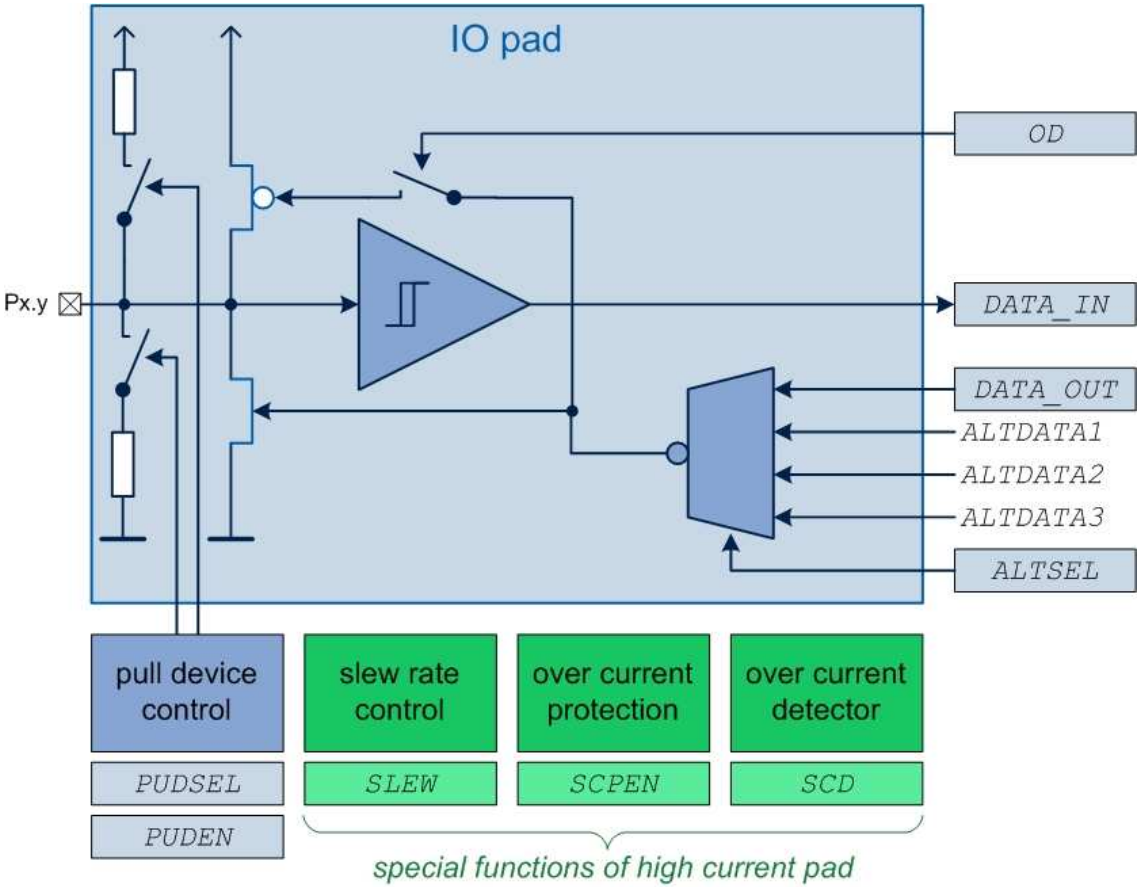


ROM Libraries
LED-Matrix and Touch Sense

- 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

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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