XC800 Peripheral Highlights

8-bit microcontrollers

July 2008

Industrial and Multimarket Microcontroller – AIM MC IMM

Never stop thinking

Agenda

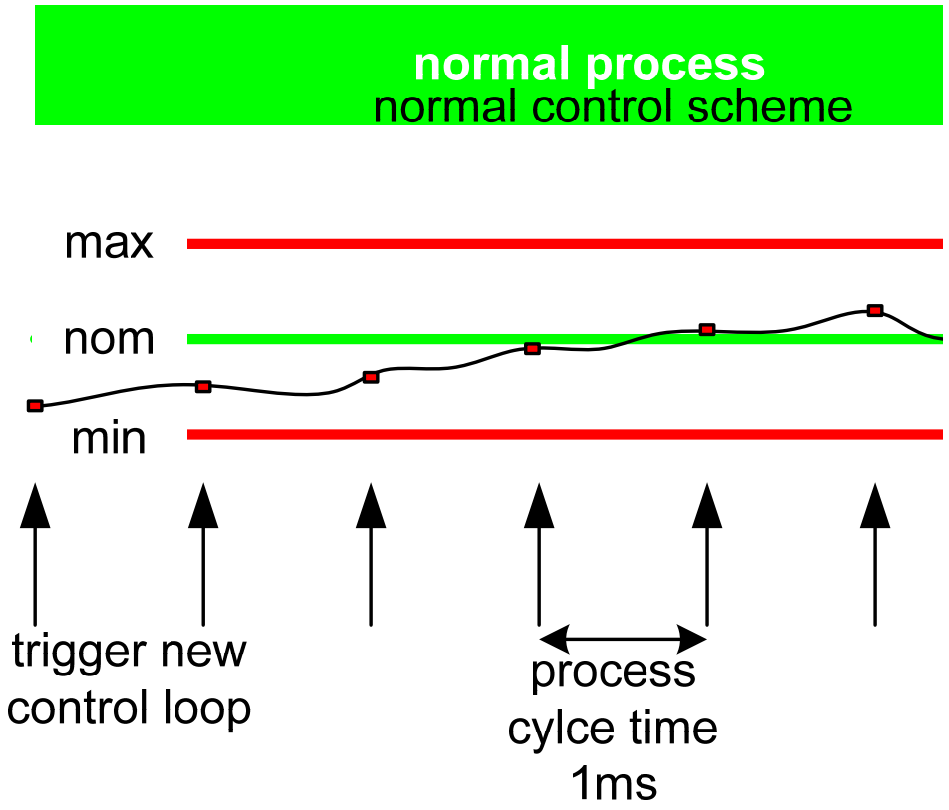
- Realtime Applications
- Example Switched Mode Power Supply – CC6
- Example Current Measurement – CC6 & ADC
- Example Board Selftest – Ports
- Example Touchpad – CC6 & Ports

Realtime Applications

- Realtime applications need:
  - computing performance – this can be easily calculated
  - guaranteed reaction time – this is difficult to guarantee
  - → together this is called Realtime Performance

- How to get Realtime Performance
  - use powerful MCU architectures (busses, datawidth, MUL/DIV pipeline...)
    - ... this is quite expensive
  - use good interrupt controllers
    - ... 8051 has significant good interrupt performance
  - use high clockspeed
    - ... this is very expensive → fast memory, high current consumption etc...
  - use intelligent peripherals
    - ... this needs application knowhow and technical expertise

CPU vs. Peripheral Performance
Example: Servo Motor of a CNC Machine



Via CPU

- Check limits every 2µs
- Assumption: 20 instructions
- **Additional 10 MIPS CPU performance needed** for a "background" task!

Via autonomous peripherals

- Check limits every 2µs in ADC
- Trigger PWM unit directly in case of limit violation
- **Zero additional CPU load**

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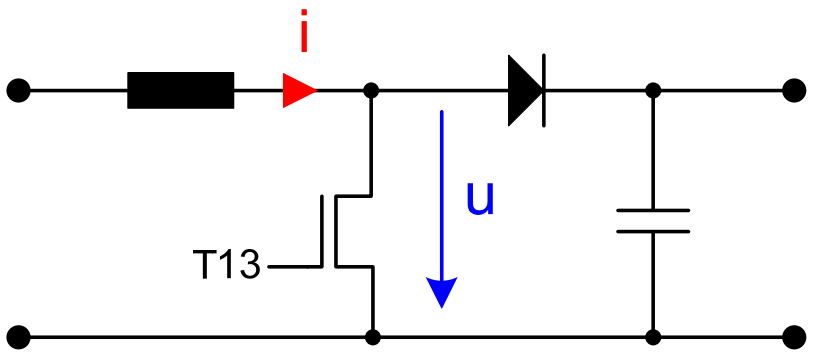
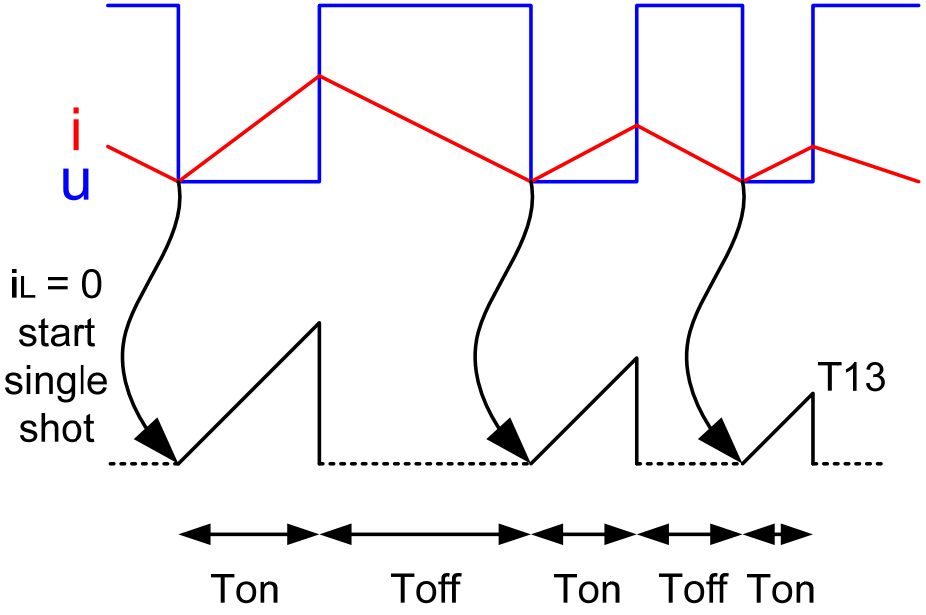
Example Switched Mode Power Supply – CC6

- for flyback converters, stepdown converters, PFC etc. a typical problem is that the switch control requires variable period and duty cycle
- a standard PWM module cannot do this – the signal is much too fast
- this is called
  - critical conduction mode
  - discontinuous mode etc...
- CC6 can solve this problem
  - T13 in single shot mode
  - start T13 on external event (T13HR)
- By this an aperiodic signal can be generated @ 100kHz (Ton + Toff ≠ contstant)





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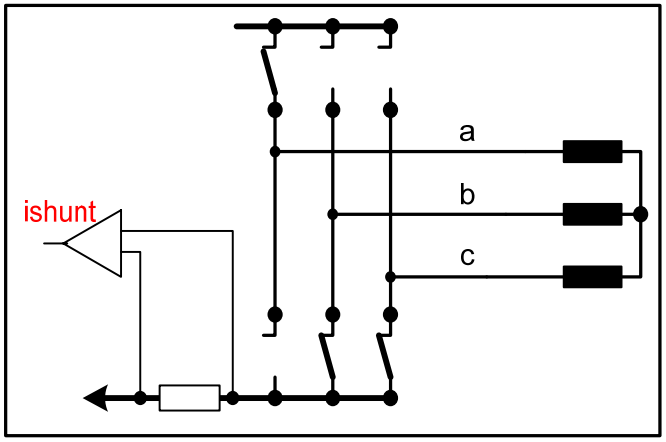
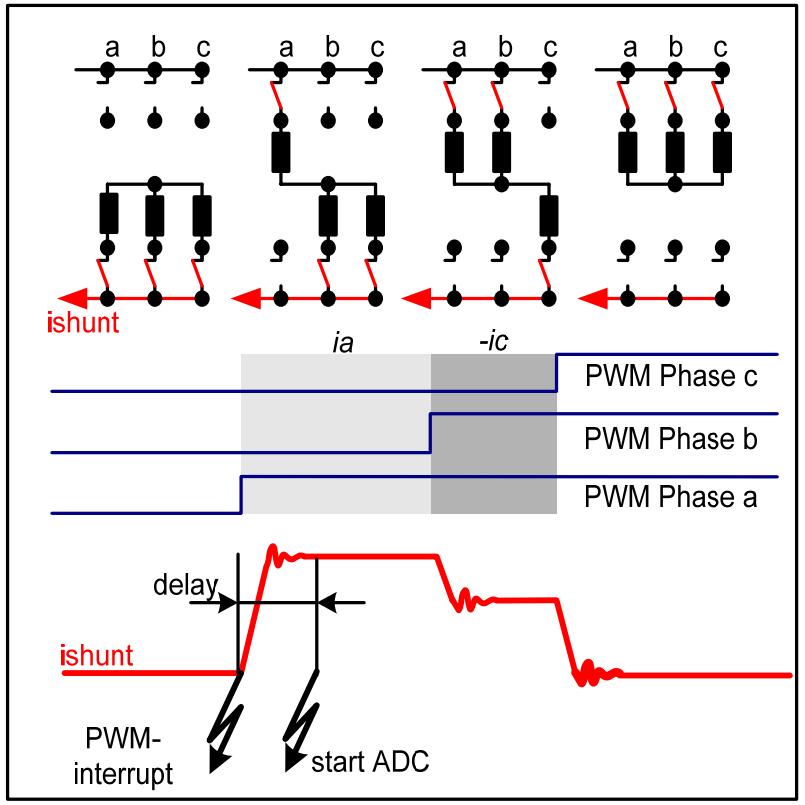
Example Current Measurement – CC6 & ADC

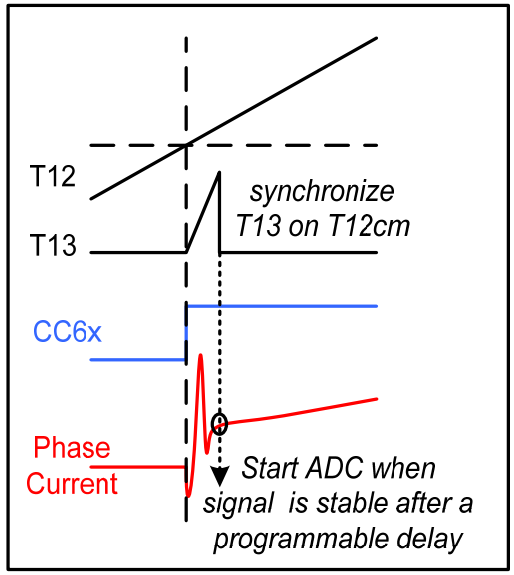
- Single Shunt Current Measurement for SVM Controlled Motors
  - ADC can be triggered by hardware „time-accurate“
  - T13 and T12 are synchronized by hardware
  - ADC result is stored automatically
  - decoupling of software and hardware



Topology



Space Vector Modulation (SVM)



Noisefree sampling (T13PM)

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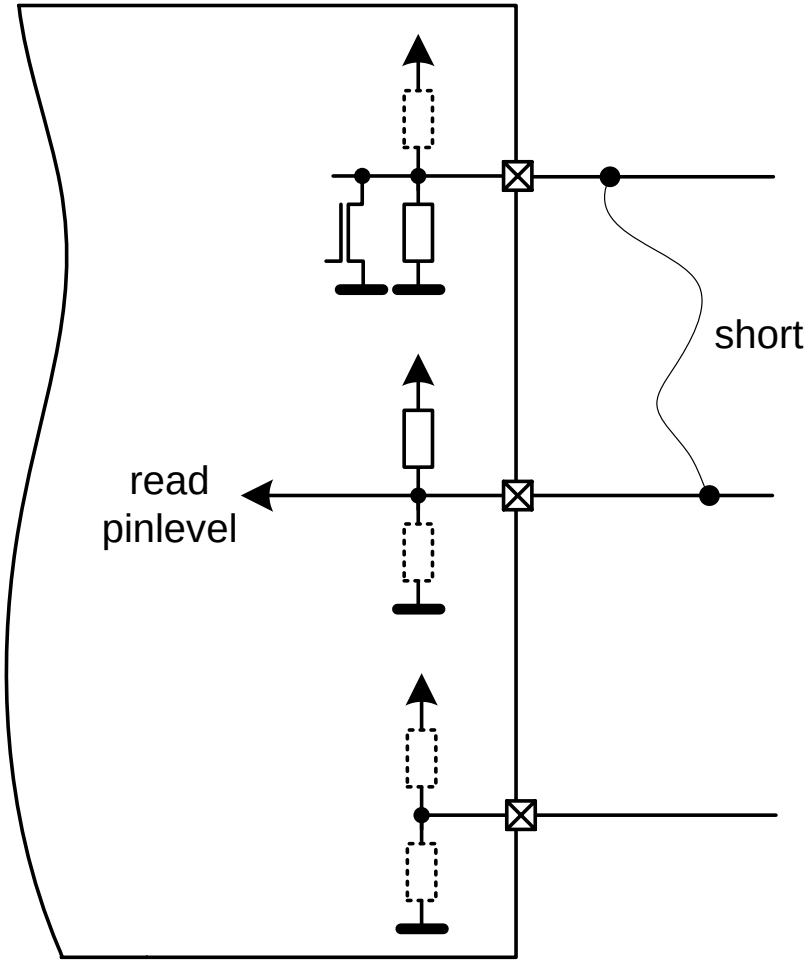
Example Board Selftest – Ports

- Using flexible port feature
  - programmable pullup / pulldown
  - strong pull with opendrain
- Short-Detection of two neighbour pins on boardlevel
- Emulation of external signals by pullup/down stimulation
  - → external interrupts
  - → external sensors, even analog
  - → capture events
  - etc.



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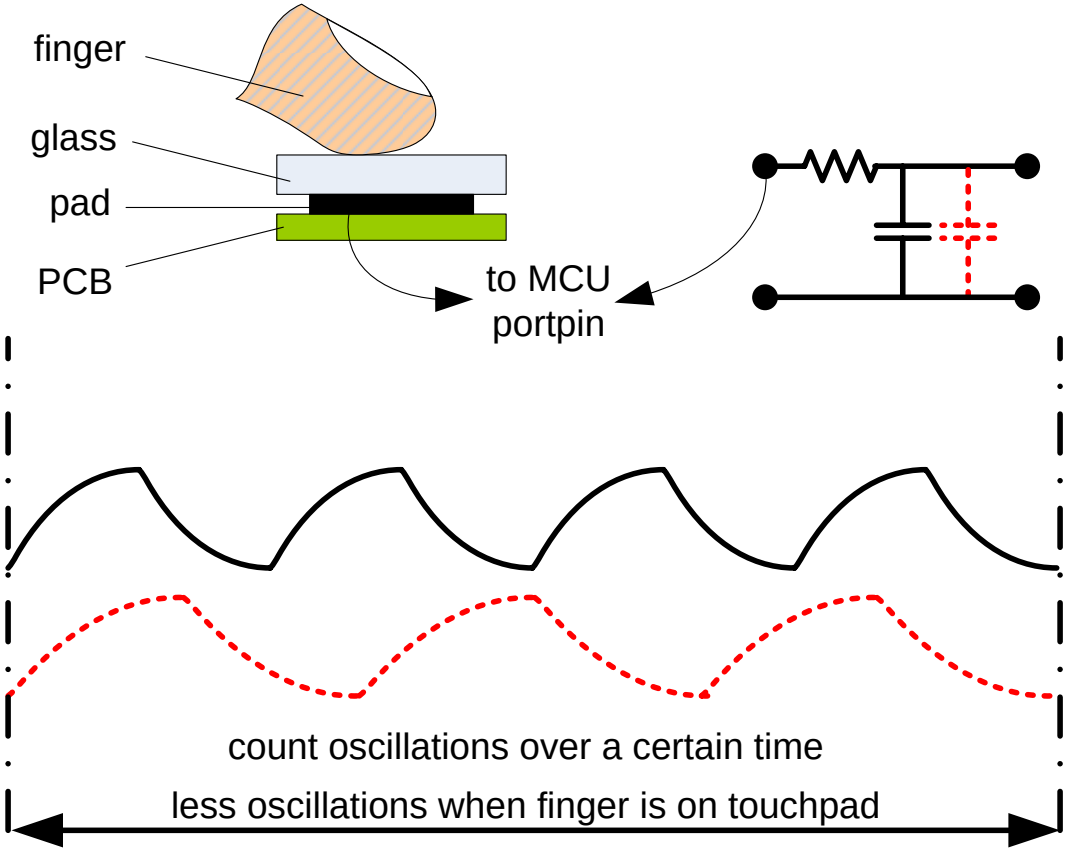
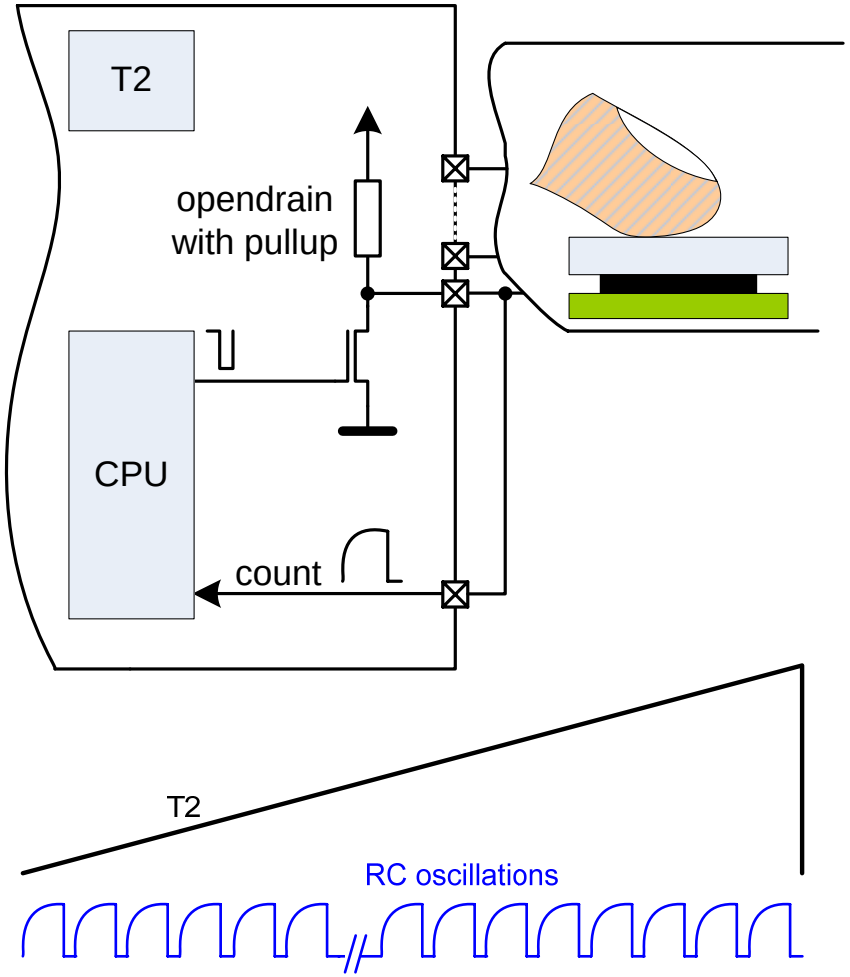
Example Touchpad (1)

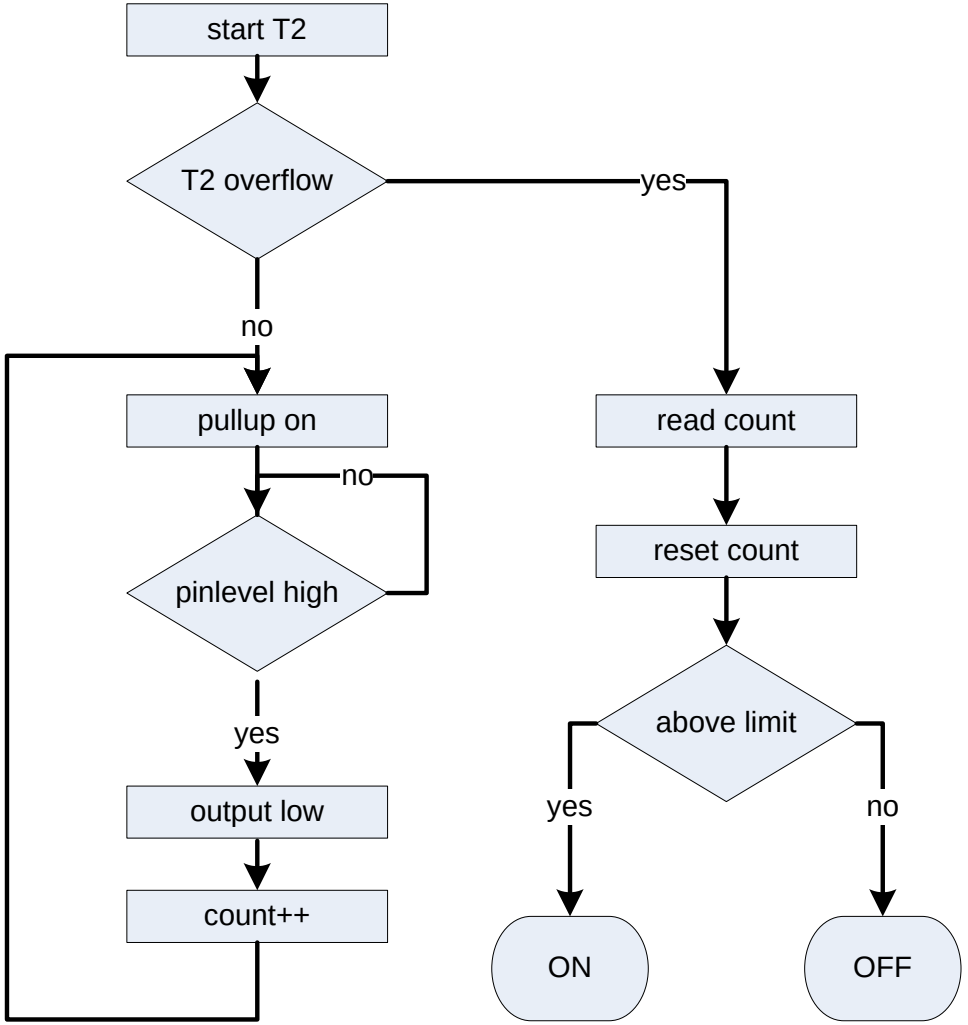
- A Touchpad is a capacitive switch
  - without electro-mechanical parts
  - with galvanic isolation
- It works like a RC oscillator where the
  - C is changed by the „touching finger“



Example Touchpad (2)

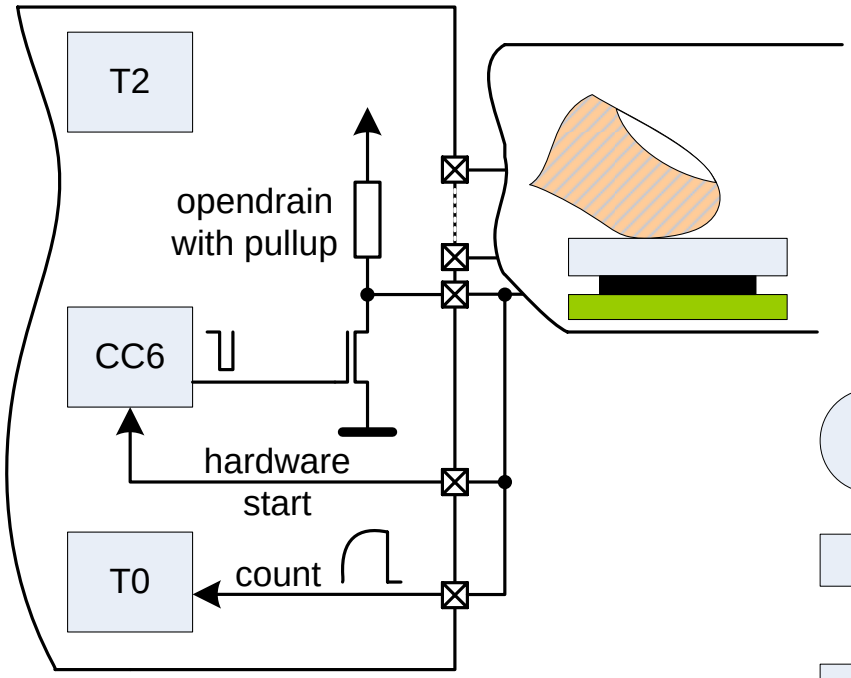
- SW Solution – 100% CPU load

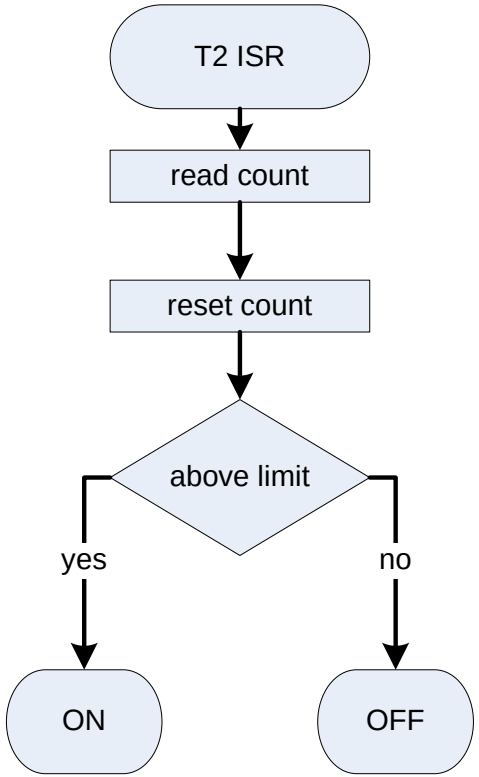


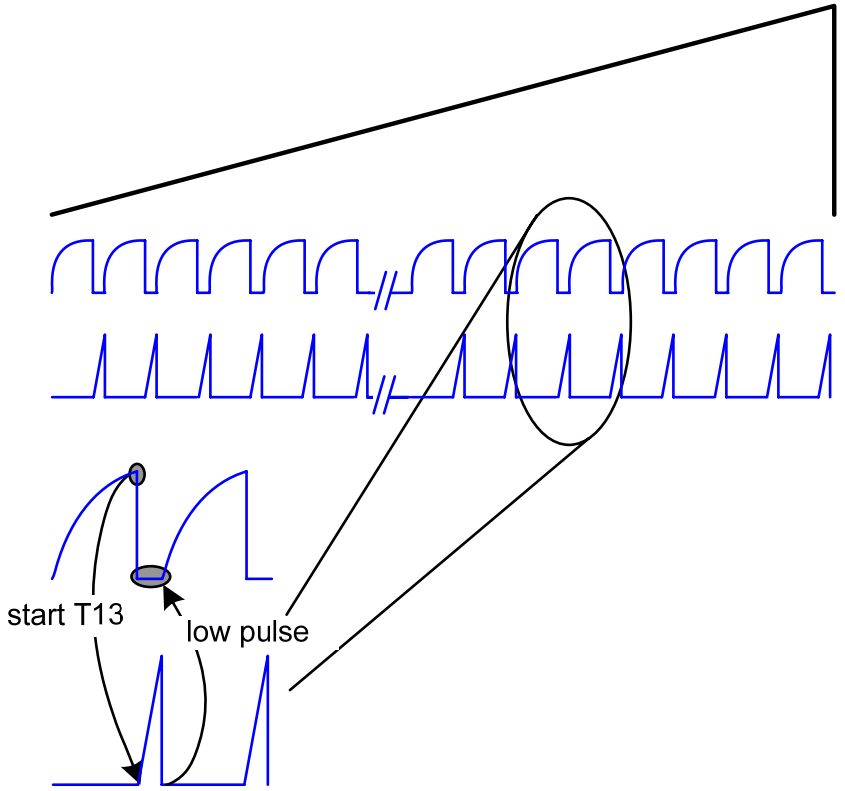


Example Touchpad (3)

- HW Solution – zero CPU load







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