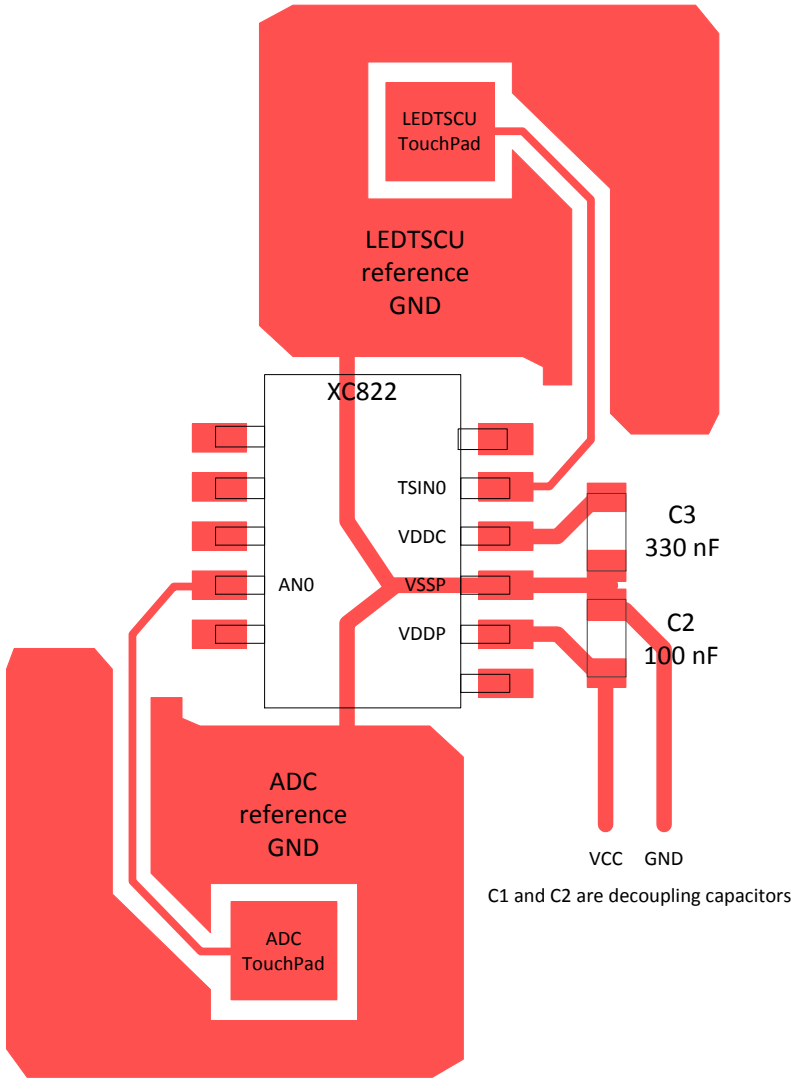
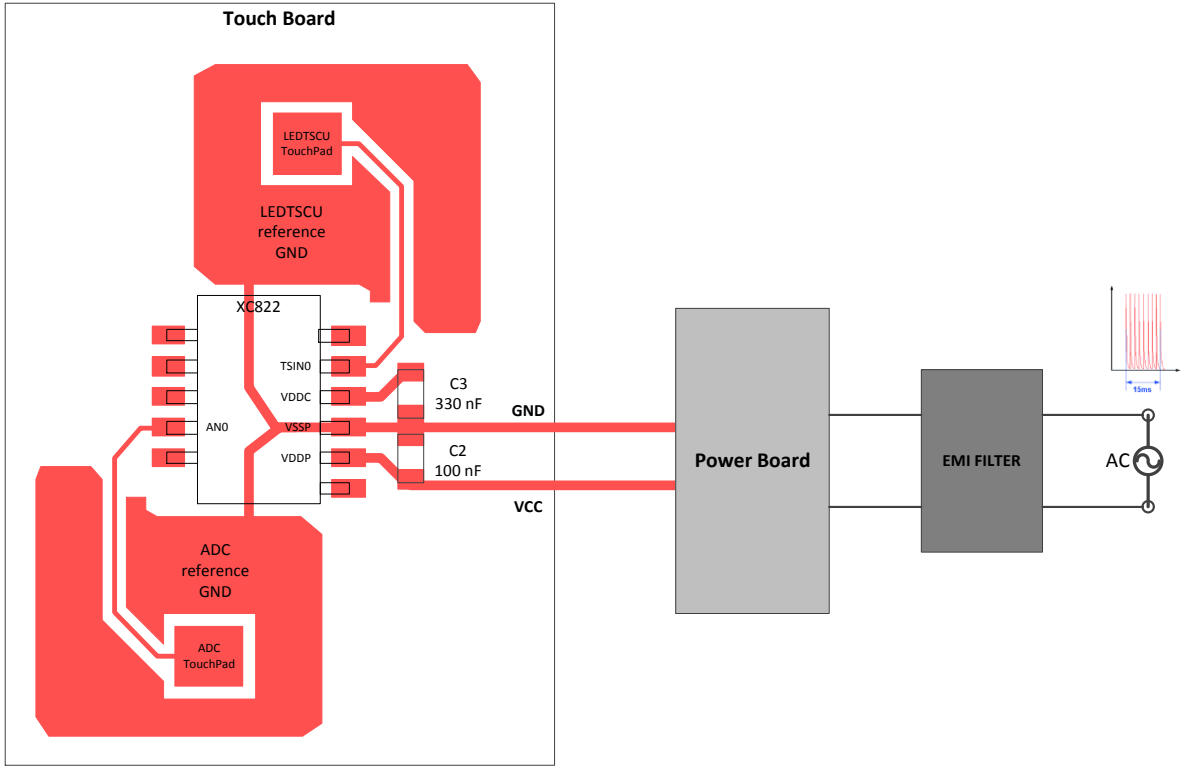
PCB Layout

- Separate signal domains with separate reference grounds
- Surround traces and pads with respective ground plane
- Connect all grounds in a star connection near the VSSP pin, otherwise keep the grounds away from each other to minimize coupling



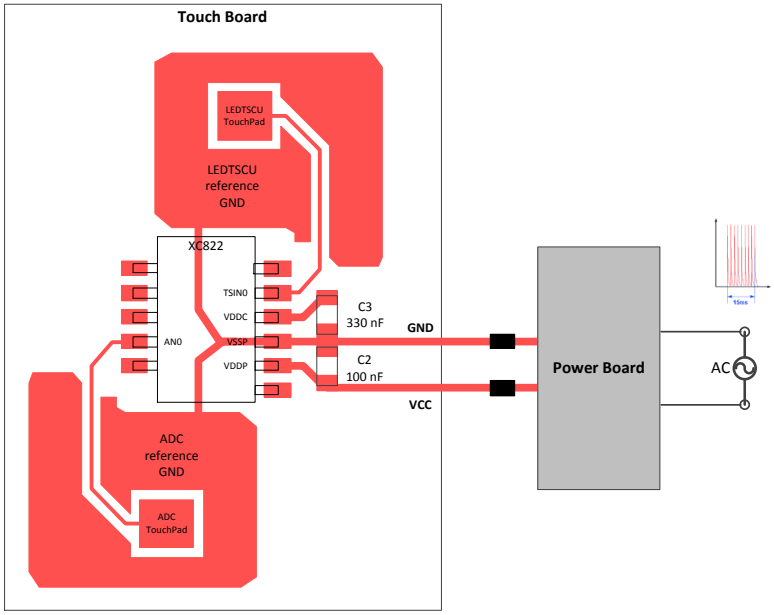
EFT (Electrical Fast Transient)

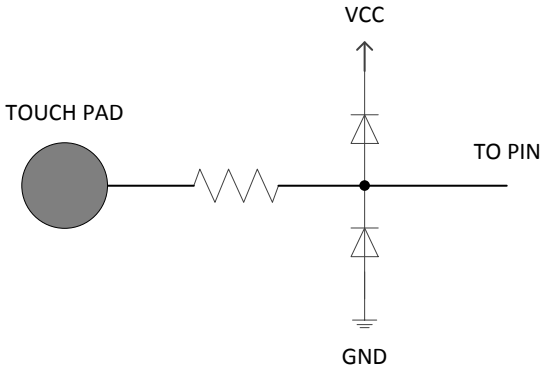
- Common home appliance requirement, e.g. IEC61000-4-4
  - Noise bursts enter user board via AC line
  - Common practice to **omit** the **input filter** (common-mode choke) to cut costs leaving the user board with no noise filtering at the input
- Touching the pads couples the user board to earth
  - With no filtering, the noise directly enters VDDP/VSSP via ESD structure on pins etc.
    - The implementation may be less robust



EFT (Electrical Fast Transient)

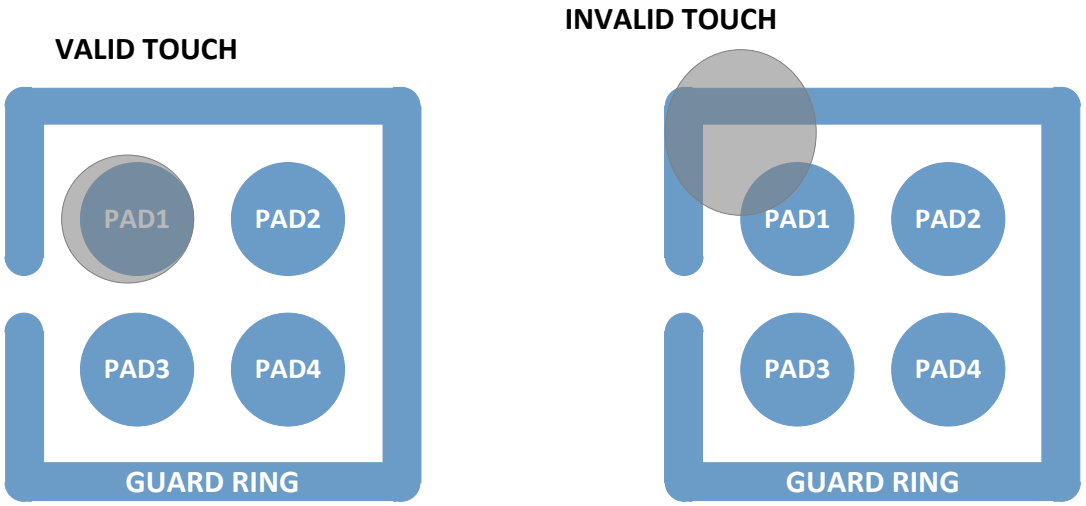
- **Low-cost counter-measures**
  - Separate the microcontroller board from the power board
    - Put inductors or ferrite-beads in the ground and VCC paths at the connector to decouple the two boards
    - A resistor/transistor should be put in other signal paths between the power board and the microcontroller board
    - This works against all types of conducted noise
  - Build an external clamping structure (with low capacitance) with a series resistor on the sensitive pads to reduce the noise that enters the microcontroller
    - The ground and VCC should be in a separate domain from the microcontroller's ground/VCC so the noise gets directed away from the microcontroller
  - Put a 5.1V Zener diode parallel to the filtering capacitor on VDDP





Guard Pad

- Essentially an extra touch pad that is more sensitive than the other regular touch pads
- When this pad is activated, an error state (e.g. invalid touch) is assumed and all other pads are ignored
  - RF noise
  - Touch at a wrong location (guard ring)
  - Water on the board surface



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