Power Supply Considerations for Atmel® Capacitive-touch ICs

1. Introduction

This application note discusses the dedicated power supply arrangement for Atmel capacitive touch-sensitive integrated circuits (QT™ ICs).

2. Why Do I Need a Special Power Supply?

QT ICs derive their internal reference from the Vdd power supply. It is therefore important to ensure that Vdd is stable and free of electrical noise. The proprietary drift compensation algorithms of the QT IC are designed to overcome long-term drift. Nevertheless, transient spikes of ±10 mV can cause erratic behaviour such as false key activations, stuck keys, and loss of touch detection.

A simple and inexpensive regulator circuit eliminates these potential problems.

3. General Recommendations

Do:

- Use a dedicated regulator to power the QT IC.
- Place the regulator as close as possible to the QT IC.
- Use a GROUND plane under the regulator and under the Vss pins of the QT IC.
- For PCBs with a GROUND plane layer, extend the plane under communications circuits, any oscillator or crystal, and also decoupling capacitors.
- Place a 0.1 µF decoupling capacitor in close physical proximity to each Vdd pin.

Don't:

- Share Vdd with other logic circuitry or light-emitting diodes (LED).
- Use long power and GROUND traces between the regulator and the QT IC.
- Extend the GROUND plane beneath the sense pins of the QT IC, Cs capacitors, Rs resistors, or any sense line traces.

4. Low Drop-out (LDO) Regulator

QT ICs are optimized for low power operation. To conserve power, the device mostly operates in an ultra-low-power sleep mode in which minimal current (µA) is drawn. Periodically, the QT IC wakes up to perform sampling and communication routines that consume mA of current.

The poor load step response of some LDO regulators is well-known, often resulting in significant output transients when the load increases from µA to mA, causing erratic sensor operation. Care must be taken in the selection and use of LDO regulators. Figure 4-1 shows the circuit for a Seiko S-817 series LDO regulator.

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Application Note QTAN0015

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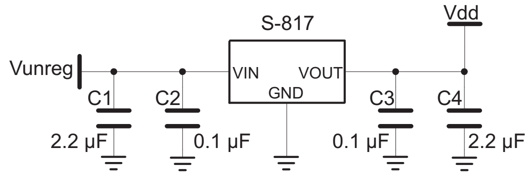
Figure 4-1. LDO Regulator Circuit



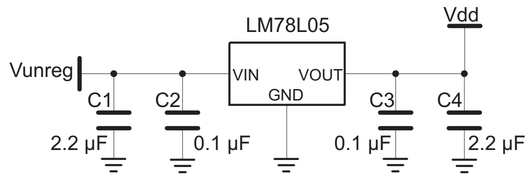
The Seiko S-817 regulator has a good load step response and reliable performance when used with QT ICs. Low quiescent current makes the S-817 regulator especially suitable for battery-driven applications.

C2 and C3 should be good quality ceramic capacitors, placed as close as possible to the regulator. An additional ceramic capacitor should be placed close to the Vdd pin on the QT IC.

5. Standard Linear Regulator

Figure 5-1 shows the circuit for an LM78L05 linear regulator.

Figure 5-1. Linear Regulator Circuit (LM78L05)



C2 and C3 should be good quality ceramic capacitors, placed as close as possible to the regulator. An additional ceramic capacitor should be placed close to the Vdd pin on the QT IC.

6. Direct Battery Power

The internal resistance of a battery causes the voltage to drop as the load increases, so load variations result in voltage transients. As the battery ages and discharges, its internal resistance increases and the transient effects worsen. To overcome these characteristics, QT ICs should be powered from an LDO regulator connected between the QT IC and the battery.

Exceptionally, a QT IC can be safely powered directly from the battery, but this can only be done in applications in which the battery load remains relatively constant. Particularly on older batteries, a delta value of >10 mV can be caused merely by flashing an LED or driving a small relay coil.

7. Associated Publications

The following document published by Atmel's Touch Technology Division is also of interest:

- QTAN0017 – Checking the Effects of External Noise on Atmel Capacitive-touch ICs

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