Conversion Issues for QT11x Devices to QT11xA Flash Devices

1. Introduction

In order to reduce cost and sustain availability, the following 8-pin QTouch™ devices have been converted to Flash devices (“A” revision):

- QT11x
- QT11xH
- QT1Cxx

The newer Flash devices are functionally equivalent to the older devices except that they are more sensitive. This note describes two ways to compensate for the sensitivity differences in existing designs.

Note that the Flash (“A”) versions of these devices are not recommended for new designs.

2. Electrical Differences

The general electrical behavior (for example, voltage range and timing) of the old and new series of devices is identical and therefore will not cause any measurable differences in performance. However, the intrinsic pin capacitance of the new Flash devices is significantly lower than in the old devices, by 5 pF per pin. Since two pins are used (SNS1, SNS2), the Cx load on the QT™ circuit is 10 pF lower than with the old parts. The net effect of this is that, in the same circuit, the new Flash devices will have longer burst lengths and will be more sensitive than the old devices.

The degree of enhanced sensitivity is dependent entirely on the amount of stray capacitive loading of the PCB and electrode. For example, if the chip is very close to the electrode, and there is very little ground plane around the traces and electrode, the external Cx will be low, and the internal I/O pin Cx will matter even more.

Measuring the amount of external Cx loading is not easy as it requires a good capacitance meter and careful handling of the test probes; 50 percent reading errors are common, making measurement results very imprecise and difficult to rely on. This application note therefore focuses on two simple, but effective, methods for compensating for the added gain.

3. Assessing Performance Differences

In preparation for making circuit changes, it is important to measure the sensitivity to touch of the old chip, preferably in a quantitative way. While it is possible to do this subjectively, the best way is to measure the change of burst length, given a change in loading (Cx), via a small external coupling capacitance. This can take the form of a coin glued to the front panel over the electrode area, which is alternately connected or disconnected to ground via a wire (See Figure 3-1 on page 2). Changes in the burst length (in pulse count) can be noted using an oscilloscope connected to SNS1 or SNS2 via a high value resistor, such as 470 kΩ (see Figure 3-2 on page 2)

Conversion Issues for QT Flash Devices

Application Note QTAN0029

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Figure 3-1. Test Setup for the Quantitative Determination of Signal Delta Due to Touch

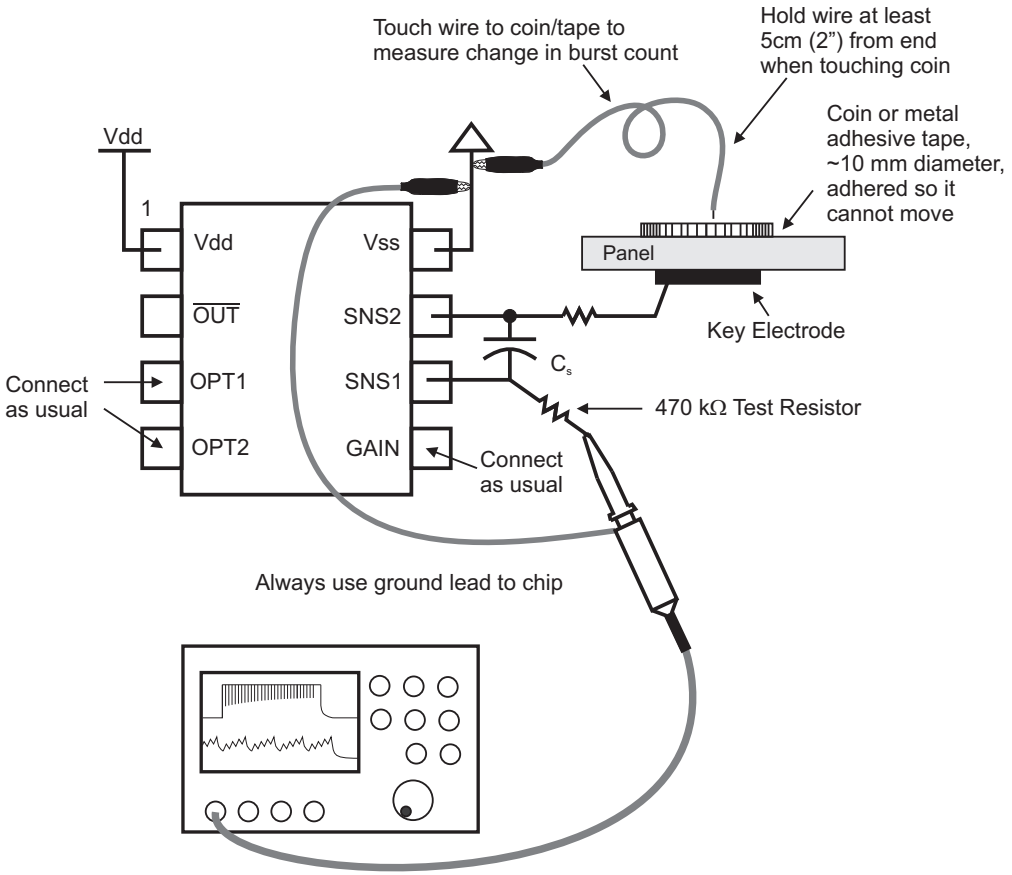
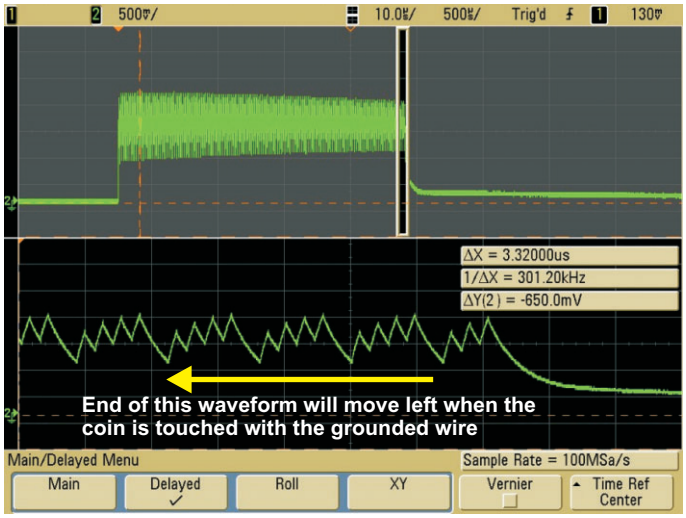


Figure 3-2. Oscilloscope Output Showing Changes in Burst Length



The top waveform is a full acquisition burst; the bottom waveform is an expansion of the end of this burst (outlined in the vertical white box). Each sawtooth peak in the lower waveform represents a pulse count. On grounding the coin, the lower waveform will shorten to the left. Take note of the difference in pulses when grounded and not grounded – this delta should be within 10 percent between the two chip types.

For consistency, make sure that you use the same supply voltage that will be used in the target application.

The absolute number of burst pulses is not important. What is important is the *change* in the burst pulses when the coin is grounded. This change should be matched with the new Flash chip to within 10 percent (see Section 4.1).

The change can easily be measured by counting pulses backwards from the *end* of the burst.

4. Altering the Sensitivity

4.1 Solution #1: Change Cs

Changing Cs is the preferred way to alter sensitivity for QTouch based devices. Decreasing Cs will cause sensitivity to drop; if Cs is reduced enough.

When doing the tests, lower Cs in standard increments (for example, from 10 nF to 8.2 nF) and at each increment, measure the change of the burst length on the oscilloscope as described in Section 3 on page 1.

When the change due to grounding the coin matches the old part's change under the same test to within 10 precent, you have found the value of Cs that you need.

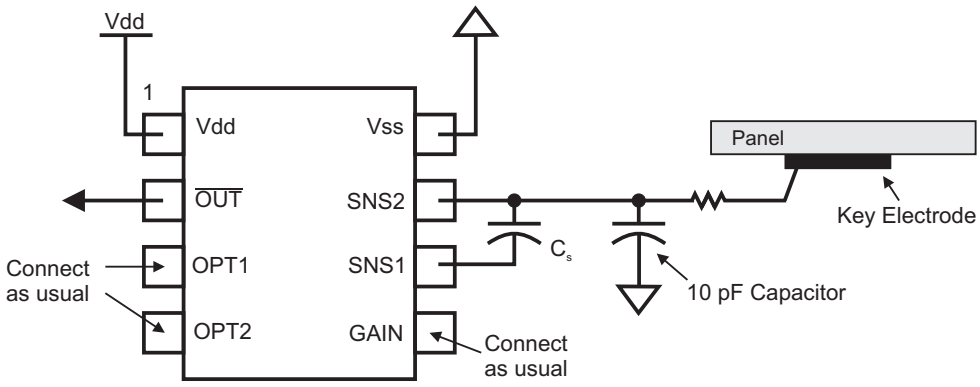
Note that it is wise to use precise Cs capacitors (5 percent tolerance or better) for these tests; poor tolerance capacitors can result in a wrong selection of value. Use a capacitance meter to find the most accurate capacitor possible.

4.2 Solution #2: Add 10 pF to an SNS pin

Another way to compensate for the new part is to add 10 pF of extra Cx from either SNS1 or SNS2 pin to ground. This will compensate for the 5 pF per pin difference of the two part types, resulting in an identical performance match (see Figure 4-1).

Make sure that you verify the change in burst length, as in Section 3 on page 1.

Figure 4-1. Method to Compensate the Flash Chip Using a 10 pF Capacitor to Ground



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