E115 USER GUIDE

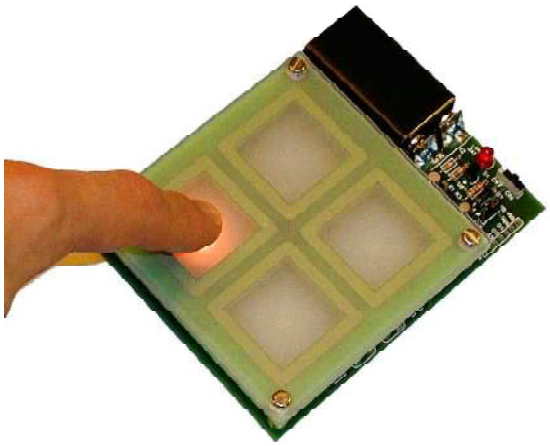
Overview

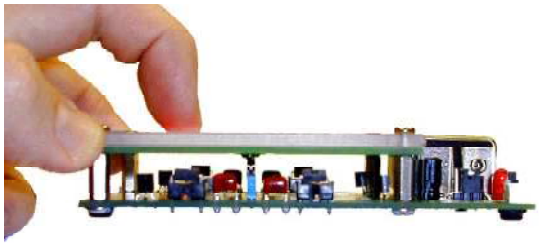
The E115 board is designed for rapid evaluation of the QT115H 'sync chip' QTouch™ IC. The board includes four keys with corresponding backlighting LEDs to indicate touch on each key.

The keys are made using squares of copper area around empty holes in a PCB located under the plastic panel. A piece of translucent material diffuses the light from the LEDs to provide a broader area of illumination.

Connections are provided for external interfacing, and several E115's can be connected together for extended daisy-chaining of two or more E115 boards.

The board is powered by a single 9V alkaline battery with a low-voltage detect LED.





Using the E115

To use the board right away:

1. Insert a 9V alkaline battery into the clips on the board.
2. Place the E115 on a desk, or hold the board so your fingers do not come near the keys or the circuitry on the sides of the main board (there are sensitive components and traces there; If they do, keys may calibrate against your finger or detect your finger, causing LEDs to come on).
3. Turn on the power slide switch. The ICs require less than a second to calibrate; after this time you can touch the keys to make them light up, in any combination.

How it Works

The E115 has four QT115H chips, one for each key. A connector in the middle of the main PCB conducts the sense traces to the top PCB 'key plane' to turn the four squares into independent touch sensors.

The gains of the QT115H's are set high enough (by using appropriate values of Cs caps) so that the sensing fields will penetrate through the plastic panel laterally into the centers of the squares. The squares are not isolated from each other via ground traces; since the QT115H's operate in time-sequence, they do not cross-interfere with each other. Furthermore, each sense electrode is connected to ground while waiting its turn to sense, so that the touch action does not bleed across into adjacent keys.

This configuration lets the sense fields permeate the centers of each key but not outwards from each key. Touching near the edge of one key will not cause an adjacent key to detect.

A schematic of the E115 is found at the end of this guide.

Board Details

Battery & Power Switch
The power switch is located above the battery. Due to the current drain of the board, it is advised to leave this switch Off when not in use.

Always use a 9V alkaline battery.

Low Power LED
A low power LED located next to the switch will light when battery voltage drops below about 7.5 volts. Below this voltage, false or erratic operation can be expected. If it illuminates at any time other than briefly at first power-up, you should replace the battery.

Output / Interface Connector
The output interface connector is located next to the power switch. This connector (a series of pads on the PCB) has the switching signals from each of the four QT115H ICs. In addition, you can use the Vbb pin of this connector to power the board from an external power source, from 8 to 12 volts DC.

Remove the battery if using external power! Failure to remove it will cause unintended charging of the battery which will lead to electrolyte leakage and an explosion hazard!

Although the power is regulated onboard via a 78L05 device, raw power should be free from switching noise and short-term fluctuations for best performance.

QT115H Circuitry
Each key's corresponding circuitry is located directly beneath it.

The QT115H ICs are located near the edges of the main PCB, and are socketed. The associated QT sample capacitors (C5, C6, C7, C8, also referred to as 'Cs caps') are located near their respective QT115H, and these are socketed in low-profile pin sockets to allow for easy experimentation. They can be easily replaced with a pair of tweezers.

When replacing these capacitors, use only X7R ceramic caps, or, (best) plastic film caps. Higher values will make the keys more sensitive.

The QT115H ICs have active-high outputs, which are used to drive NPN transistors that in turn drive the high intensity LED's.

Sync Connections and Options
The QT115H ICs are connected together in a daisy-chain so that the first device in the chain, U1, acts as the master device. When U1's QT sense burst has completed, it sends a sync pulse to the next QT115H, U2, so that it will generate its sensing burst, and so on until U4 senses. The physical location of the four corresponding keys is such that even if U4's burst overlaps U1's burst, there will be minimal cross-interference; corresponding keys 1 and 4 are diagonally placed with respect to each other on the panel, and thus have minimal cross-capacitance.

In longer chains, consideration should be given to key and wiring placement so that QT115's 'down the line' do not couple fields into earlier devices in the chain. If this happens, the two cross-coupling devices will become unstable and may false-detect. Normally this is not a problem, but these concerns may require careful consideration of key sequencing and wiring.

Daisy-Chaining E115 Boards: Two or more E115's may be placed in series with the first board having the master IC, and with the second board's U1 being slaved to U4 of the first E115 board. **Jumper J3** (located near the power

switch) can be set to allow the second board to place it's U1 in slave mode. Wiring the **'Chain-Out'** of the first board to the **'Chain-In'** of the second board will create the required sync link.

Keys
The four keys on the board are simply wide square traces surrounding open holes in a PCB layer under the plastic panel. A light diffuser layer acts to soften and spread the light from the high intensity LED's located on the main board under each key. The sense field projects through the plastic panel to create the touch areas.

Key sensitivity is governed by the value of Cs for each key (see section above, *QT115H Circuitry*) and each Cs can be different for each IC.

Recalibration Timeout
Each key has an individual time-out function that allows recovery from 'stuck key' conditions that may be caused by foreign objects. The time-out fixed at 10 seconds.

After 10 seconds of *continuous* detection, the affected key will automatically recalibrate itself to the signal present at the moment of recalibration. This can be demonstrated by touching a key for the duration of the timeout setting.

Drift Compensation
Each key compensates for signal drift due to humidity, temperature effects, dielectric changes, etc. and will do so continuously over the life of the sensor.

The drift compensation mechanism only occurs at times when a valid touch is not being sensed.

If a key is touched for a duration longer than the recalibration timeout interval (see above) and the key is released thereafter, the key logic will then drift compensate automatically to return to its normal calibration point. The logic of the QT115 is always self-healing.

Output Lines
The four output lines, OUT1...OUT4, are all active-high. They remain high for the duration of a touch or until the calibration timeout interval has expired for a particular key. These signals can be found on the Output connector pads located near to the power switch.

E115 Board Schematic