E1080

User Manual

The New Vision of Touch™

E1080

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OVERVIEW

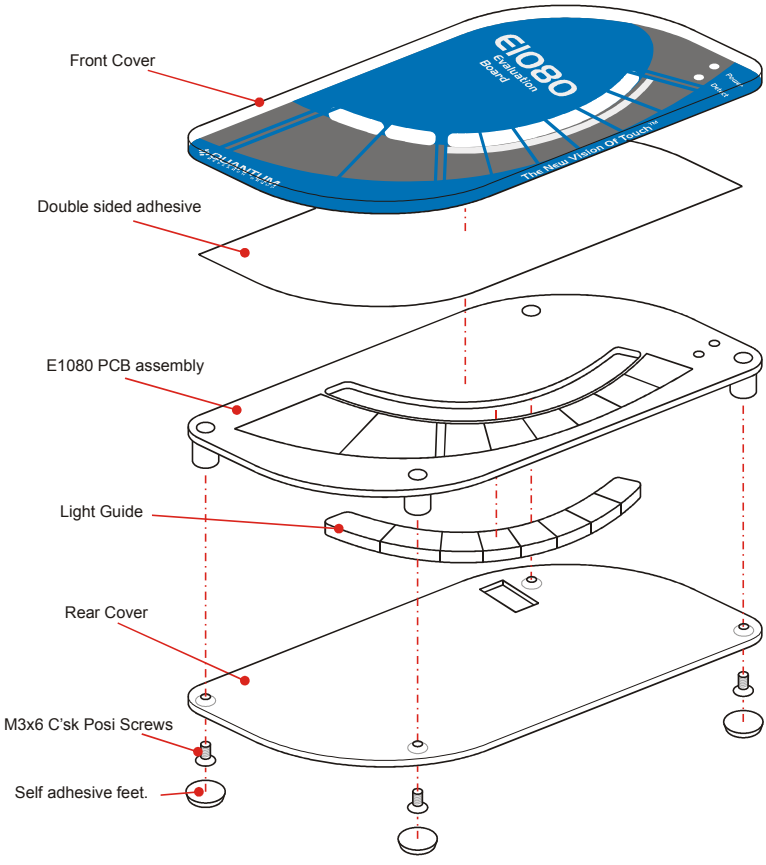
The E1080 is designed to let you evaluate and develop with the QT1080 8key QTouch™ IC. It includes eight independent touch sensitive electrodes with corresponding LEDs to indicate touch. Connections are provided for external interfacing. The E1080 is powered from an external 7V to 12V DC source (such as a common 9V battery).

For more detailed information about this product please refer to the latest QT1080 datasheet at www.qprox.com/datasheets.

Materials Provided:
1 x E1080 Evaluation Board
1 x 9V battery
2 x Sample QT1080-ISG chips (32QFN package) *
2 x Sample QT1080-IS48G chips (48SSOP package) *
1 x User guide

* Note: Pin-out of the two different package types are not identical. Please refer to the QT1080 datasheet.

BOARD CONSTRUCTION



RUNNING THE E1080

To run the E1080:

1 Place the E1080 on a table, touch side up.

2 Connect the 9V battery making sure your fingers are clear of the touch areas to allow proper no-touch calibration.

The E1080 is now ready to use. Touch the keys to light the LEDs.

A continuous touch of 10 seconds (factory settings, as received) will cause the key to recalibrate. Releasing the key after such an event and waiting a few seconds will cause the key to recalibrate yet again, allowing the key to function normally thereafter.

The E1080 is a stand-alone module which facilitates the evaluation of QT1080-ISG by allowing easy access to the various functions, features and options which the IC provides.

QT1080-ISG is a cost-effective versatile chip which is aimed at a broad base of uses, from portable devices such as mobile phones or MP3 players through to home appliances and automotive applications. The option settings on the E1080 allow the user to investigate the most appropriate settings for their applications prior to committing to custom PCB design.

The E1080 also provides an interesting example of back-lighting using an innovative light-guide assembly. Increasingly, capacitive user interface technology combined with appropriate use of back lighting and imaginative front panel designs are providing product differentiation for leading edge developers.

We encourage you to experiment with the evaluation board and to contact us with any questions you may have through email or the online user-forum.

The QT1080 scans the keys using bursts of charge-transfer pulses. Immediately after power up, the signals from these bursts are used to calibrate the baseline reference values of the keys. This makes the device highly adaptive to mechanical differences (i.e. varying panel thickness). The chip also performs drift compensation on a continuous basis, so that the signals are constantly being adjusted at a slow rate to accommodate environmental factors.

The power-up calibration process should be performed in an undisturbed neutral condition, i.e. all fingers away from the keys and with the board situated in the location where it will be used. Changes in location can change the amount of signal coupling between the back of the keypad and the local environment and thereby affect the sensitivity of the keys. If the initial calibrations are in error, allowing the board to settle for a few seconds will allow the drift calibration process to normalise the keys to the correct calibrated values.

The Q1080 features spread-spectrum pulse modulation which heavily suppresses external noise effects, while also suppressing radiated emissions. This powerful feature provides for highly reliable, compliant operation over a wide variety of conditions.

The chip also uses a 'Detect Integrator' to reduce false detection by verifying that a key is reporting touch for 6 consecutive bursts; if the device fails to detect a touch during any of these 6 signal samples the chip will not report a key touch on an Out pin. Combined with spread-spectrum operation, the detect integration consensus filter provides a powerful mechanism to suppress false detections by external noise sources.

AKS™ [Adjacent Key Suppression] is a patent-pending feature that can be enabled via jumper resistors. AKS works by preventing multiple keys from responding to a single touch, previously a limitation of close packed capacitive touch key arrays. AKS operates by comparing signal strengths from keys within a specified group to suppress touch signals from those keys that have a weaker change in signal than that of the dominant key.

The QT1080 has two different AKS groupings, selectable via option resistors (SW1 on the E1080 Board.) These groupings are:

- AKS operates in two groups of 4 keys.
- AKS operates over all 8 keys. (Global AKS)

These two modes allow the designer to provide AKS while also providing for shift or function operations. AKS may also be turned off to facilitate full multi touch operation. In the AKS disabled setting, all keys operate independently and simultaneously.

If a key is touched for longer than 10 seconds, the key is flagged as a 'stuck key' and the QT1080 recalibrates it so that the corresponding LED will go out, and the key will operate again as a normal key while suppressing the object (i.e. a touch) that caused the prolonged detection. Only the 'stuck key' is recalibrated, as all electrodes operate independently. The 10s timeout can be changed to 60s or infinite via switch SW1.

The QT1080 features a low power (LP) mode for sub 30uA levels of current drain with a slower response, to allow use in portable battery operated devices. On detection of touch, the QT1080 automatically reverts to its normal mode and asserts the DETECT pin active to wake a host controller. The device remains in normal, full acquire speed mode until another pulse is detected on its SYNC/LP pin, when it goes back to LP mode.

The E1080 is a simple double-sided PCB on industry standard FR4 material. All parts are standard surface mount types. Here is a brief description of some of the parts and features.

Keys — Keys consists of capacitive electrodes formed using copper areas on the E1080 which project a capacitive field through the overlying dielectric (acrylic) panel material.

Electrodes — Copper areas on the PCB which define the touch keys.

LEDs — The board has one 'Power' LED which remains on as long as the board is powered, one 'Detect' LED to indicate a key has been touched and one LED per key to indicate touch.

Keyboard J1 — By cutting through Links LK0~LK7 and connecting to J1, remote custom keys can be connected to the E1080. (If the E1080 keys are required later, Zero Ohm Resistors should be soldered at LK0~LK7 and the connections at J1 must be removed)

Interface J2 — The main interface connector of the E1080 board. The pinout of this connector is shown in Table 1. The pin functions are as follows:

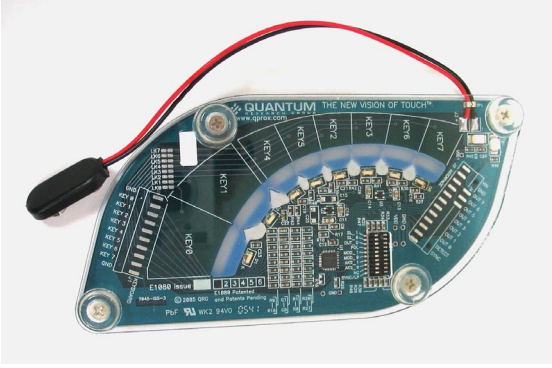
[1] SYNC — SYNC is available in slow mode only and is used to synchronize the E1080 burst with an external falling edge signal, often derived from a 50 or 60Hz source to suppress mains interference, or to allow two or more QT1080 chips to synchronize to each other, to prevent cross-interference effects between the adjacent keys of different chips.

[2] DETECT—DETECT can be used to wake a battery-operated product following a human touch. DETECT also indicates to a host when the binary coded output pins (in that mode) are show an active key.

[3..10] OUT '0' ~ OUT '7' — OUT pins are low when the corresponding key is inactive and high when active, and are controlled by the QT1080 chip. These lines also control the LEDs on the E1080.

[11, 12] GND, VIN — Use +7VDC to +12VDC connected between the GND and VIN to power the E1080 board. The battery snap feeds the same two connections, and can also be used for power input. The input is protected from incorrect polarity connection.

Board Layout



Interface J2 Pinout

Pin	Description	Pin	Description
1	SYNC	**7**	OUT_4
2	DETECT	**8**	OUT_5
3	OUT_0	**9**	OUT_6
4	OUT_1	**10**	OUT_7
5	OUT_2	**11**	GND
6	OUT_3	**12**	VIN

The sensitivity of the keys has been tailored to match the fitted plastic front panel and keypad size and shapes. To make a key more sensitive, increase the value of its corresponding Cs capacitor (see chart below). To make it less sensitive, decrease it's Cs value. Only use 5% or 10% X7R ceramic capacitors; most other types are not sufficiently stable and give erratic results.

Sense Capacitor Values

Key #	Cs Capacitor	Factory Default
0	C1	12nF
1	C2	6.8nF
2	C3	22nF
3	C4	18nF
4	C5	18nF
5	C6	18nF
6	C7	22nF
7	C8	18nF

Figure 2 — Schematic Diagram

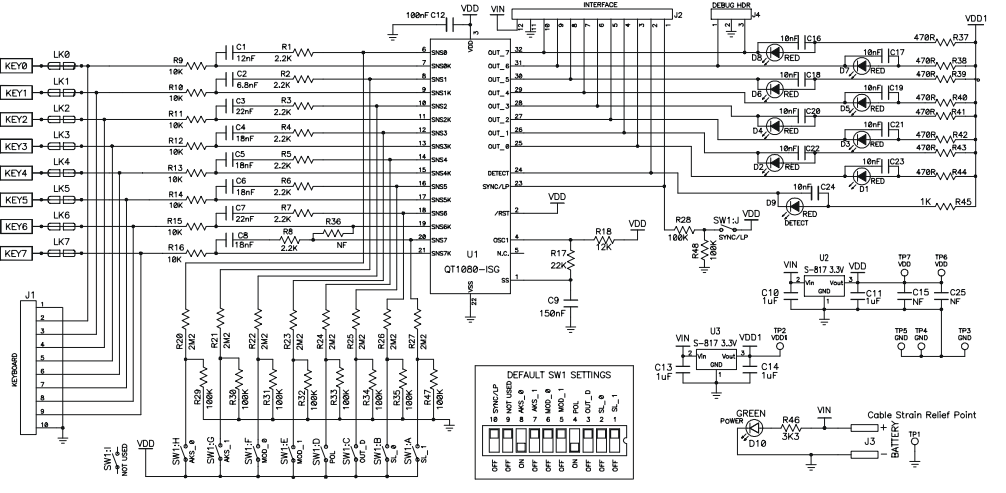


Figure 3 — Bottom Copper Layer

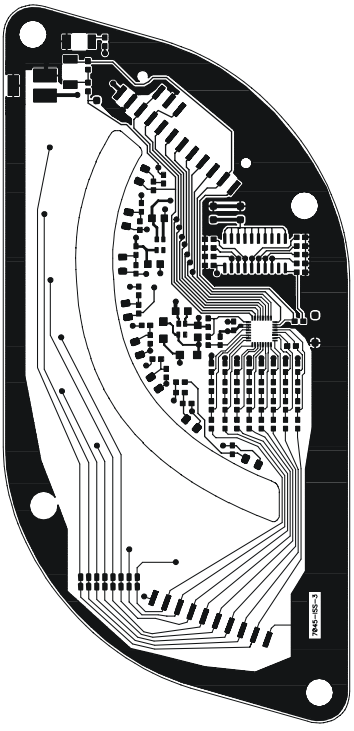


Figure 4—Top Copper Layer

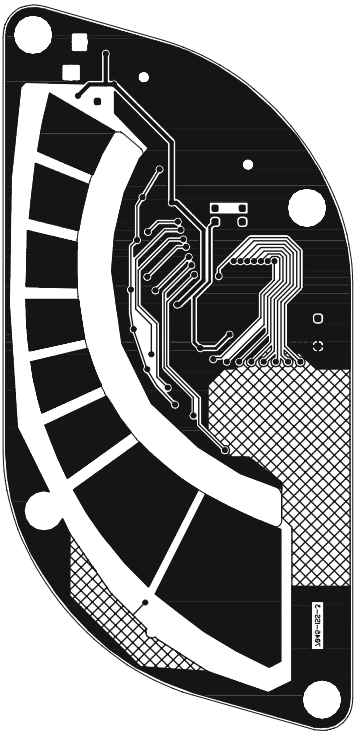
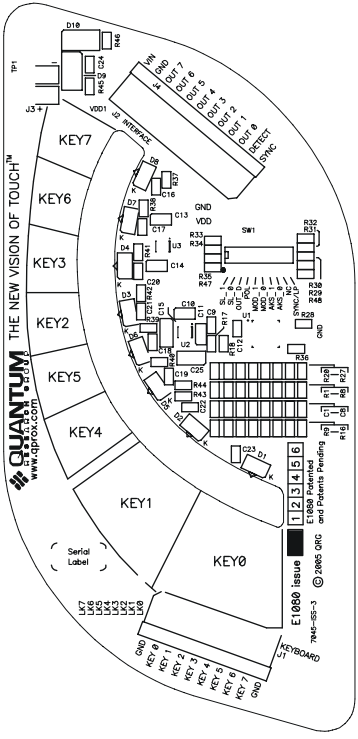
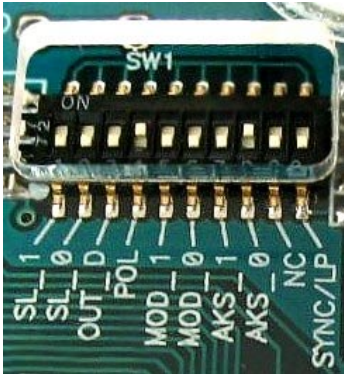


Figure 5 — Silkscreen Layer



The QT1080 is designed for maximum flexibility and can be reconfigured to accommodate several options. These can be set by toggling or adjusting the switches on SW1:

Identification	Factory Default
SL_1	OFF
SL_0	OFF
OUT_D	OFF
POL	ON
MOD_1	OFF
MOD_0	OFF
AKS_1	OFF
AKS_0	ON
NC	OFF
SYNC/LP	OFF



Sync Mode*: (SL_0 ON, SL_1 OFF): allows synchronize acquire bursts to an external signal source, such as mains frequency, to suppress interference such as mains frequency, or to synchronize more than two QT parts with Sync facility.

Low Power Mode*: Allows the device to enter a slow mode with very low power consumption on start up, in one of three response time settings When a key is touched, the QT1080 goes into Sync mode (wakes up) until the host requests otherwise. When fitted in a system there will be a pulse from the host micro controller asking for the QT1080 to go back into LP mode. For the purpose of this demonstration unit, the SYNC/LP switch can be toggled to simulate this signal.

SL_0	SL_1	Response Time
ON	**OFF**	120 ms
OFF	**ON**	200 ms
ON	**ON**	360 ms

OPTIONS

Maximum 'ON' duration setting: Determines how long a key touch can be sensed before it is reset. The Maximum 'ON' duration operates on a key-by-key basis; i.e. when one key is stuck on, its re-calibration has no effect on other keys.

MOD_0	MOD_1	Maximum 'ON' Duration
OFF	**OFF**	10 Seconds
ON	**OFF**	60 Seconds
OFF	**ON**	Infinite

Adjacent Key Suppression (AKS™) mode:** Prevents multiple keys from responding to a single touch.
There are two modes: Two groups of 4 (AKS_0 OFF, AKS_1 ON) or Global mode (AKS_0 ON, AKS_1 ON).
Note: the first held key will hold until released regardless of any other key being touched.

Fast Detect Mode:** Response time of less than 15mS to respond;
Normal mode (AKS_0 OFF, AKS_1 OFF), Fast Mode (AKS_0 ON, AKS_1 OFF).

Polarity setting: A start point setting for all LED's off, touch for on (POL ON, OUT_D OFF) or all LED's on and touch for off (inverted) (POL OFF, OUT_D ON).

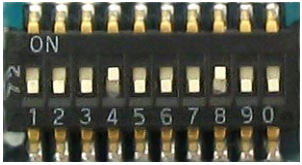
Binary Output Mode: It is possible to use all 8 outputs or use just three in 'Binary mode' (POL OFF, OUT_D OFF) where number of data lines are restricted for simplified wiring. (Refer to QT1080 datasheet for details)

- Touch KEY0 ⇨ All LED's ON
- Touch KEY1 ⇨ KEY0 LED OFF, all other LED's ON
- Touch KEY4 ⇨ KEY2 LED OFF, all other LED's ON
- Touch KEY5 ⇨ KEY2 and KEY0 LED's OFF, all other LED's ON
- Touch KEY2 ⇨ KEY1 LED OFF, all other LED's ON
- Touch KEY3 ⇨ KEY0 and KEY1 LED's OFF, all other LED's ON
- Touch KEY6 ⇨ KEY2 and KEY1 LED's OFF, all other LED's ON
- Touch KEY7 ⇨ KEY2 and KEY1 LED's OFF, all other LED's ON

(Note; * & ** Functions can not be used at the same time)

The following are examples of settings which might be useful for real world applications;

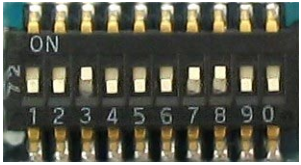
POL 'ON'; AKS_0 'ON'
(All others set to 'OFF')



Applications: Pseudo slider control, toggle on/off, keypad, movement detector.

Sync Mode:	Active
Fast Detect Mode:	Active
Start Point:	All LED's off
AKS:	Off

OUT_D 'ON'; AKS_0 'ON'; AKS_1 'ON'
(All others set to 'OFF')

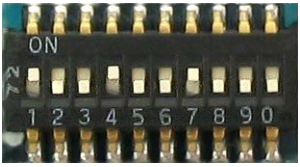


Applications: Low light environments, slider control, toggle switch, keypad.

Sync Mode:	Active
Fast Detect Mode:	Active
Start Point:	All LED's on
AKS:	Active, Global Mode
AKS:	Active 2 x 4

TYPICAL SETTINGS

SL_1 ‘ON’; POL ‘ON’; AKS_1’ON’
(All others set to ‘OFF’)



Applications: Portable appliances, mobile telephone, remote control
Low Power Mode: On, 200mS
Fast Detect Mode: Off
Start Point: All LED’s off
(Sync/LP should be toggled after every key touch to mimic the command from a micro-controller)

Does Not Work
(e.g. No Power LED illuminated)

- **Power supply too low or connected incorrectly**

Keys Not Sensitive Enough
(e.g. Detect LED does not illuminate when key is touched)

- **Keys not calibrated properly**
  - ⇨ Recalibrate or let stand for up to 10 seconds to let drift compensation work on the reference levels.
- **Power supply problem**
- **Air gap between PCB/Adhesive/Front panel**
- **Back of board is too close to a ground plane**

Noisy or Erratic Operation
(e.g. Detection of touch is intermittent)

- **Noisy or unstable power supply**
- **Supply voltage is too low**
- **Cables or board too close to a strong noise source**
(i.e., a power line or switcher)
  - ⇨ Increase the distance from the noise source
  - ⇨ Place a grounded shield between the noise source and the E1080

NOTES

QUANTUM
RESEARCH GROUP
www.qprox.com

Development Team:
Matthew Trend, John Dubery, Keith Britton

Corporate Headquarters

1 Mitchell Point
Ensign Way, Hamble
Southampton SO31 4RF
United Kingdom

Tel +44 (0)23 8056 5600
Fax +44 (0)23 8045 3939

Email sales1@qprox.com

North America

651 Holiday Drive Bldg. 5 / 300
Pittsburgh, PA 15220
USA

Tel 412-391-7367
Fax 412-291-1015

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