

QUANTUM RESEARCH GROUP

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E1106

User Manual

The New Vision of Touch™

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1 E1106 Overview

1.1 Introduction

This kit is designed for the evaluation and development of applications using the QT1106 IC. The kit includes evaluation assemblies (E1106 – see *Figure 1*), cables and QT1106 Demo software. Each E1106 assembly has a serial (USB) interface allowing connection to a computer for control and data viewing via QT1106 Demo computer software.

This unique IC allows designers to create speed or volume controls, using a wheel/slider and keys as the interface on the panel of an appliance or personal electronic device.

Refer also to the QT1106 datasheet.

1.2 Contents of Kit

1 x E1106 control board

1 x E1106 QWheel assembly

1 x E1106 QSlide assembly

1 x USB-computer cable

2 x sample QT1106 ICs

1 x CD-ROM containing information about the QT1106, including QT1106 Demo software (revision 7.2 or later) and documentation

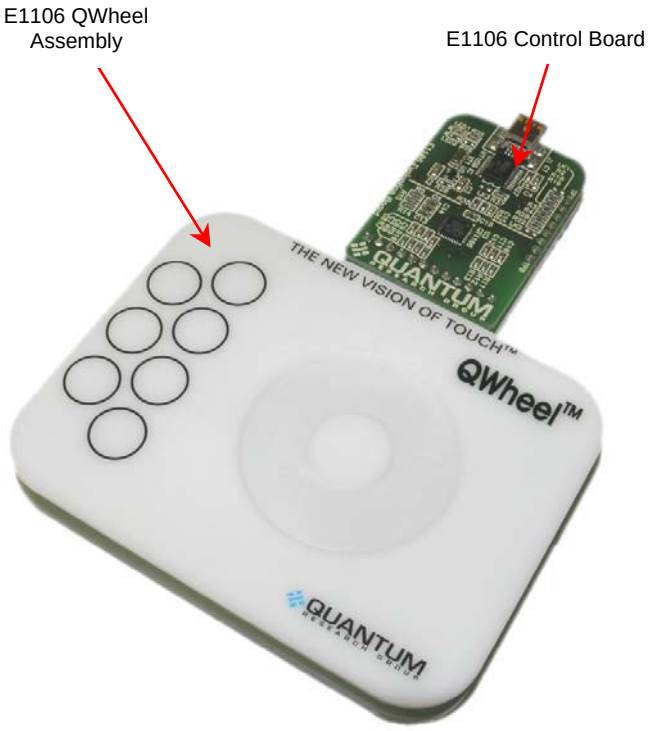


Figure 1: E1106 Evaluation Assemblies and Control Board

2 Setting Up the E1106

To prepare the E1106 for use, proceed as follows:

1. Connect the E1106 control board to the QWheel or QSlide evaluation assembly, ensuring correct orientation of the connector (see *Figure 2*).
2. Using the USB cable provided, connect the E1106 control board to the computer (see *Figure 2*). The LED on the E1106 is lit constantly to indicate that there is power to the board.
3. Install the QT1106 Demo software; either method is acceptable:

   a. Put the supplied CD in the CD drive of the computer. Copy the contents of the CD to the computer. Double-click the QT1106 Demo software to open it.

   OR

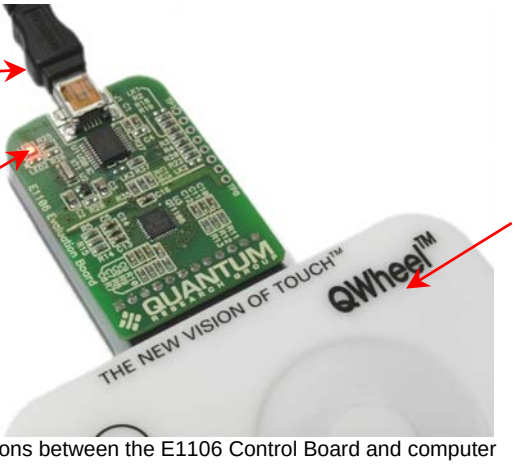
   b. Go to www.qprox.com, point to the **Support** tab and click **Download Archive**. Click **Software** and then the **QT1106 Demo** link. A dialog box appears asking if you want to run or save the file that you are about to download. Click **Run**. This automatically downloads the software.

   If a dialog box appears saying “The publisher could not be verified. Are you sure you want to run this software?” click **Run**.
4. QT1106 Demo software is displayed on the computer monitor (see *Figure 3, page 5*).

Note: the E1106 QWheel and QSlide assemblies are supplied with a grounded transparent backplate that allows the assemblies to be operated while being handheld, without requiring recalibration. The backplate can be removed if required.



Connecting the E1106 Control Board to the E1106 QWheel or QSlide



Connections between the E1106 Control Board and computer

Figure 2: E1106 Connections

3 QT1106 Demo Software

3.1 Introduction

QT1106 Demo software is used with the E1106 evaluation assembly. With QT1106 Demo software you can send commands and see the effect that changing parameters has (see *Section 3.2* onwards).

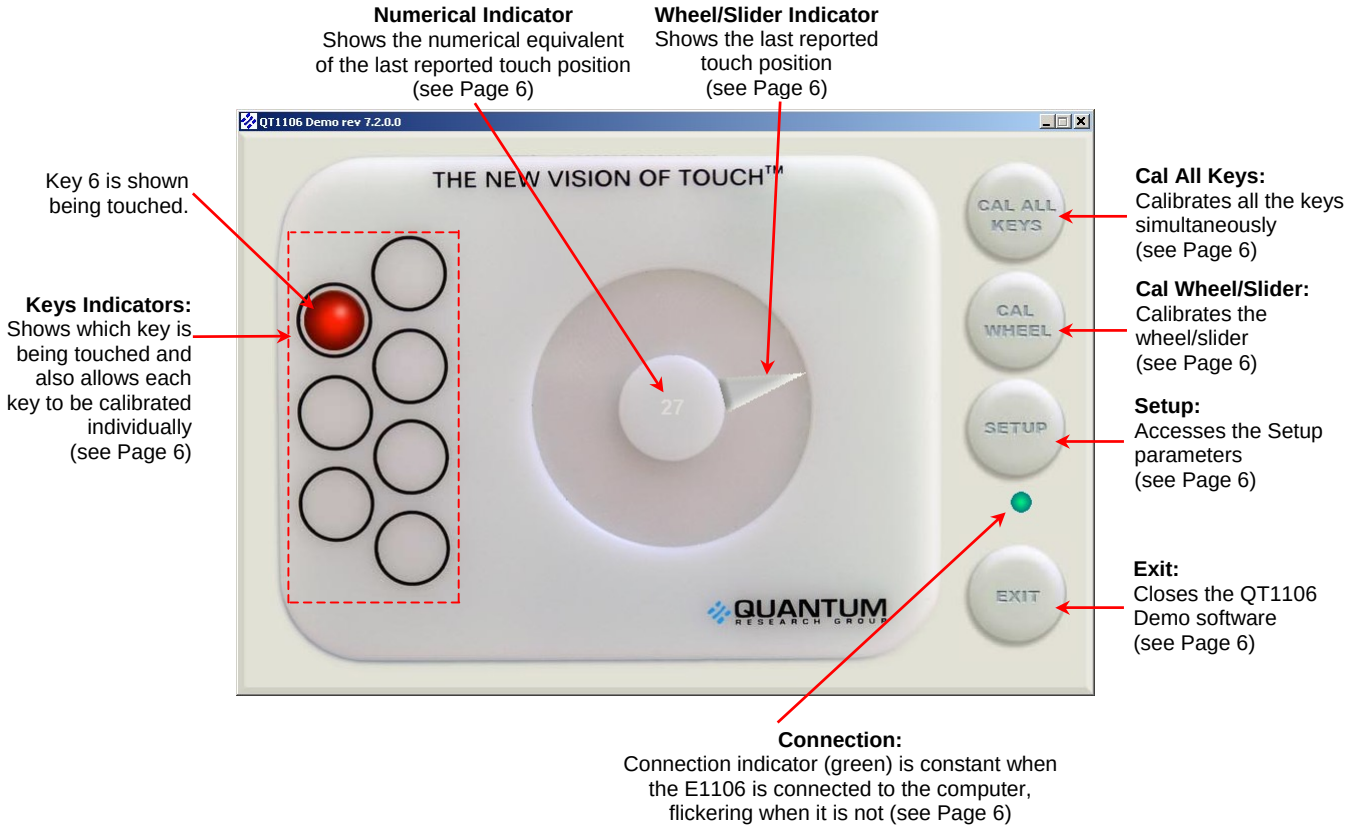


Figure 3: QT1106 Main Window

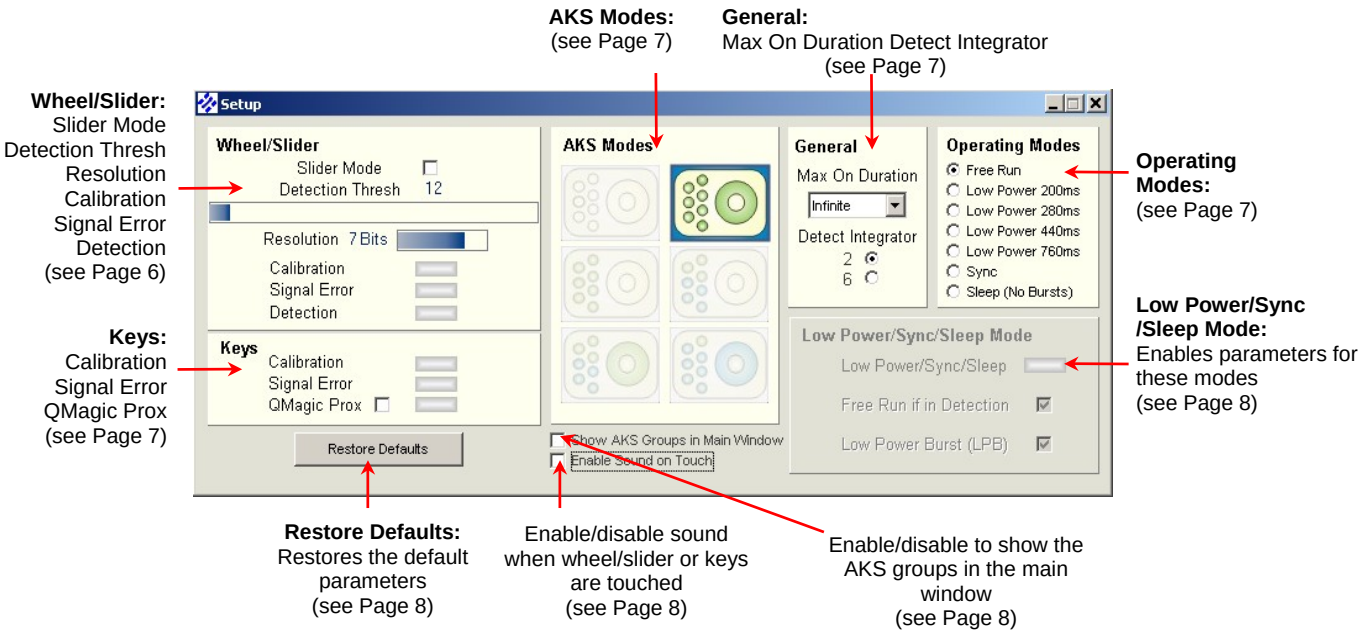


Figure 4: QT1106 Setup Dialog Box

3.2 How to Use the E1106 QWheel/QSlide Assembly

1. Place the E1106 QWheel/QSlide on a level surface.
2. Keeping clear of the E1106, click **Cal All Keys** or **Cal Wheel/Slider** (as applicable) on the QT1106 Demo software. Do this every time the E1106 is unplugged from the computer. However, if the grounded transparent backplate has been removed from the E1106 then the E1106 must also be recalibrated each time it is moved.
3. Depending upon whether the QWheel or QSlide is connected, move your finger about the wheel/slider area of the E1106. As you do so the **Wheel Indicator** shows the last reported touch position (see *Figure 3, page 5*) and the **Numerical Indicator** shows the numerical equivalent (see *Figure 3, page 5*). When you remove your finger, the last position touched will be locked on the display.
4. If the QT1106 Demo software is not detecting, or detection is sporadic, decrease the detection threshold slightly (**Detection Thresh**).
5. Refer to *Section 3.3, Page 6* onwards, for details of which parameters you can change.

3.3 QT1106 Demo Parameters

(refer to the QT1106 datasheet for more information)

The QT1106 Demo software comprises a main window and a setup dialog box. The different parameter areas simulate the effect that changing options has on the device's performance. Any option which is not available appears dimmed. Refer to *Figure 3 and Figure 4, Page 5* to see a depiction of the QT1106 Demo software.

3.4 Main Window

The **Wheel/Slider Indicator** shows the position of touch on the E1106 and its numerical equivalent is shown on the **Numerical Indicator** (from 0 to 255, depending on the resolution – see *Section 3.5.1*). This changes in real time as the position of touch on the E1106 changes.

The **Keys Indicators** show when a key is being touched; the key turns red for the duration of the touch.

Calibrate each key individually by clicking that particular key or calibrate them altogether by clicking **Cal All Keys**.

Calibrate the wheel/slider by clicking **Cal Wheel/Cal Slider**.

Access the setup parameters by clicking **Setup**.

The connection indicator (green) is constant when the E1106 is connected to the computer, flickering when it is not.

Click **Exit** to close the QT1106 Demo software.

3.5 Setup Dialog Box

3.5.1 Wheel/Slider Area

Slider Mode – the default setting for the software is the wheel. Select the check box to change the setting to the slider. A slider representation will be shown in the main window.

Detection Thresh - sets the amount of signal change which will cause the E1106 to register touch detection. The values are 0…255, default = **12**. Move the cursor over the **Detection Thresh** bar until the cursor turns into a double-headed arrow. Holding the left mouse button down, move the slider left or right to select a new threshold. The actual value is shown above the bar and changes in real time as the slider moves.

Resolution – sets the resolution of the wheel/slider; default = **7 bits**. Move the cursor over the **Resolution** bar until the cursor turns into a double-headed arrow. Holding the left mouse button down, move the slider left or right to select a new resolution. The number of bits is shown at the side of the bar and changes in real time as the slider moves.

2 Bits: 4 positions (0...3)
3 Bits: 8 positions (0...7)
4 Bits: 16 positions (0...15)
5 Bits: 32 positions (0...31)
6 Bits: 64 positions (0...63)
7 Bits: 128 positions (0...127) (**default**)
8 Bits: 256 positions (0...255)

Calibration – this indicator lights to show when wheel/slider calibration is occurring.

Signal Error – this indicator lights to show that the signal has the wrong polarity, usually due to E1106 assembly movement (when the transparent backplate is not fitted). Clicking **Cal Wheel/Cal Slider** will resolve the error.

Detection – this indicator lights when a touch is detected on the wheel/slider.

3.5.2 Keys Area

Calibration – this indicator lights to show when key calibration is occurring.

Signal Error – this indicator lights to show that the signal has the wrong polarity, usually due to E1106 assembly movement (when the transparent backplate is not fitted). Clicking **Cal All Keys** will resolve the error.

QMagic Prox – this enables proximity mode on key 7 (when the check box is selected), allowing the product to auto power up or activate its display with hand approach.

Note: once activated it can only be deactivated by clearing the check box and resetting the chip. This has to be done by physically unplugging the device. Clearing the check box is not enough.

3.5.3 AKS Modes Area

AKS Modes – Adjacent Key Suppression - this patented feature works to prevent multiple keys from responding to a single touch. It suppresses touch from weaker responding keys and only allows a dominant key (or group of keys) to detect. Click an **AKS Modes** icon to select a new AKS mode. In the main window the keys and wheel/slider backgrounds change color to indicate the grouping of the new mode (if the **Show AKS Groups in Main Window** check box is selected).

AKS disabled	(no AKS)
AKS global (**default**)	(all keys AKS'd together)
AKS K + W[1]	
AKS $4K^2 + 3K^3 + W^1$	
AKS $4K^2 + (3K^3 + W^1)$	
AKS $1K + (6K^4 + W^1)$	

3.5.4 Operating Modes Area

Operating Modes – select one of the **Operating Modes** options. If any option, apart from Free Run (**default**), is selected then the corresponding options in the **Low Power/Sync/Sleep Mode** area become available. The unavailable options appear dimmed.

[1] Wheel or Slider.
[2] keys 1-4 AKS'd together.
[3] keys 5-7 AKS'd together.
[4] keys 1-6 AKS'd together.

3.5.5 General Area

Max On Duration – the device can time out and recalibrate each key independently after a continuous touch detection that lasts for the chosen ‘Maximum on-duration’ (MOD). This ensures that a key can never become ‘stuck on’ due to foreign objects or other external influences. After recalibration the key will continue to function normally. The nominal delay is selectable to be 10s, 20s, 60s, or infinite (**default**), though the actual delay may vary in some operating modes (see the QT1106 datasheet for more information).

Detect Integrator – Detect Integrator (DI) filter confirmation reduces the effects of noise on key states. The DI mechanism requires a specified number of measurements that qualify as detections (and these must occur in a row) or the detection will not be reported. In a similar manner, the end of a touch (loss of signal) also has to be confirmed over several measurements. The QT1106 provides a choice of either two or six DI measurements for confirming start of touch; end of touch always uses two measurements. Select the appropriate check box.

3.5.6 Low Power/Sync/Sleep Mode Area

Low Power/Sync/Sleep – this indicator is lit when the QT1106 IC is in a Low Power/Sync/Sleep mode. Although a Low Power/Sync/Sleep mode may be selected in the **Operating Modes** area, when a key or the wheel/slider is touched the indicator goes out. This is because for the period of detection/touch the mode automatically changes to Free Run and then back to the original mode when detection/touch is finished.

Free Run if in Detection – select the **Free Run if in Detection** check box to automatically change the mode to Free Run whenever a touch is selected. This makes the response quicker, otherwise the device goes back to sleep for the allotted time between measurements.

Low Power Burst (LPB) – select the **LPB** check box to initiate a burst after each SPI transfer or /SS Wake pulse, clear the check box to stop the LP bursts.

3.5.7 Other Options

Restore Defaults – click this button to restore the default settings.

Show AKS Groups in Main Window – select this check box to show the selected AKS group with the keys and wheel/slider colored to show the grouping in the main window.

Enable Sound on Touch – select this check box to enable a sound to be heard when a key or the wheel/slider is touched.

4 E1106 Control Board Assembly Details

4.1 Circuit Diagram

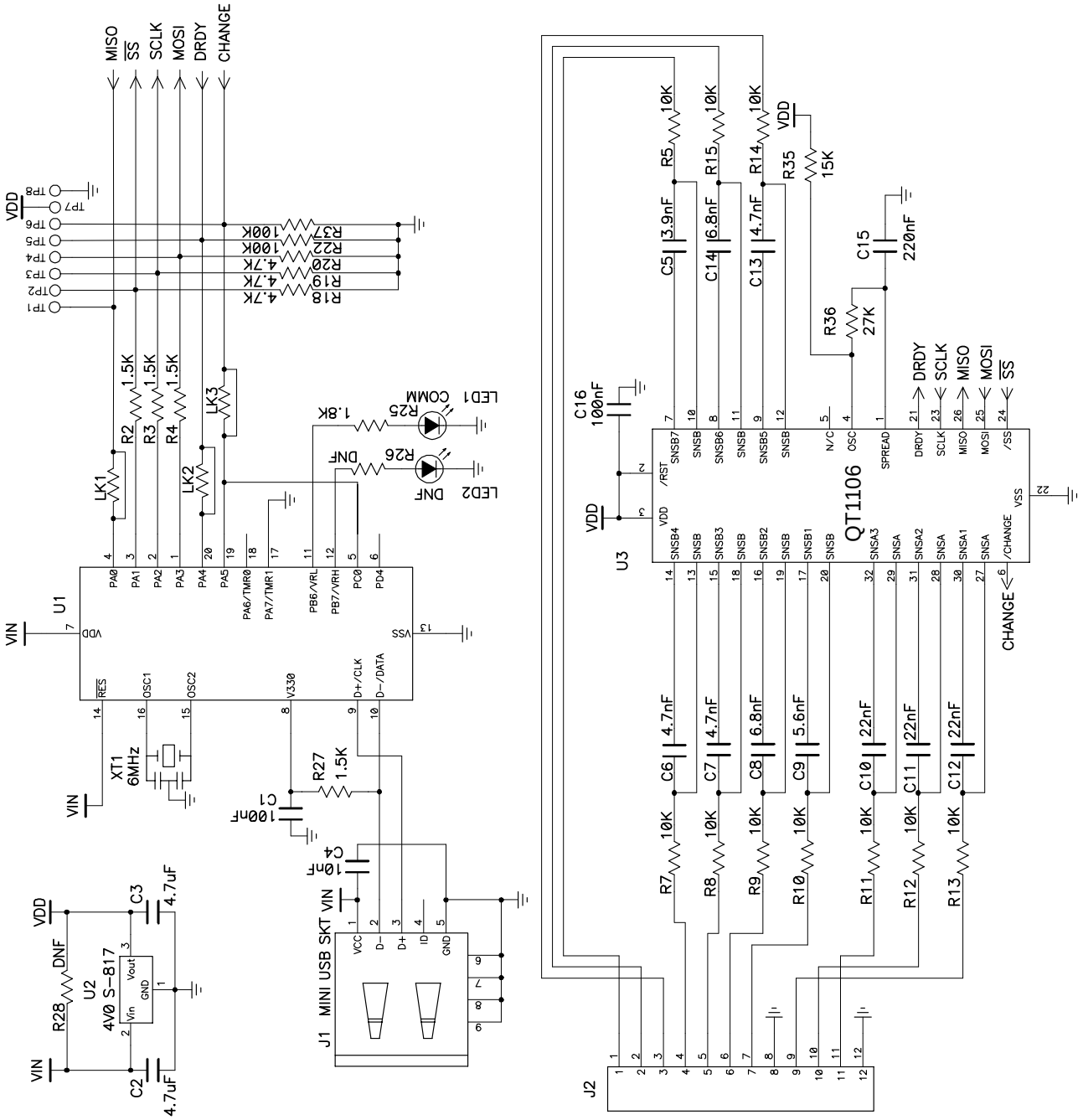


Figure 5: E1106 Circuit Diagram

4.2 E1106 Control Board Assembly Components

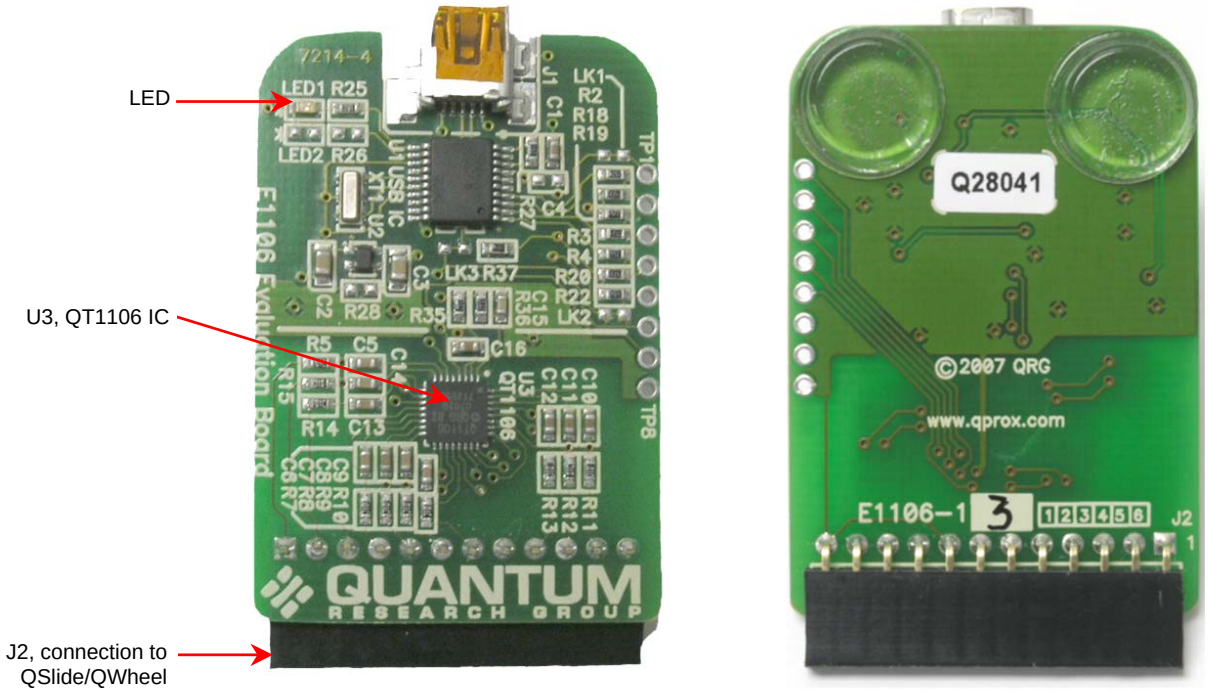


Figure 6: E1106 Control Board Assembly Details

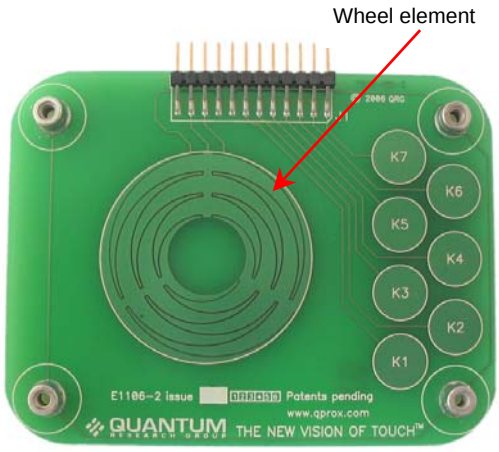


Figure 7: QWheel Assembly Details

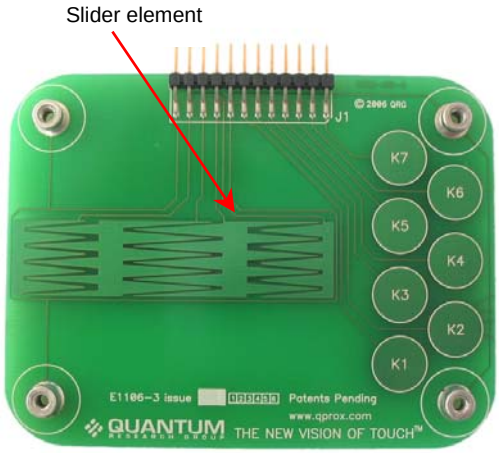


Figure 8: QSlide Assembly Details

QT1106 (32-QFN) IC

Table 1: QT1106 IC, 32-QFN (U3)

Pin	Name	Pin	Name
1	SPREAD	17	SNSB1
2	/RST	18	SNSB
3	Vdd	19	SNSB
4	OSC	20	SNSB
5	n/c	21	DRDY
6	CHANGE	22	Vss
7	SNSB7	23	SCLK
8	SNSB6	24	/SS
9	SNSB5	25	MOSI
10	SNSB	26	MISO
11	SNSB	27	SNSA
12	SNSB	28	SNSA
13	SNSB	29	SNSA
14	SNSB4	30	SNSA1
15	SNSB3	31	SNSA2
16	SNSB2	32	SNSA3

Power Supply

The QT1106 power supply should be locally regulated using a three-terminal device, to between 2.8V and 5.0V.

Wheel Element

The wheel element is resistorless and consists of etched copper electrodes.

Slider Element

The slider element is resistorless and consists of etched copper electrodes.

Sampling Capacitors

C5…C14 are the Cs sampling capacitors. Increasing their value will increase sensitivity and resolution of measurement, but will also tend to make the response time slower.

LED

The LED will switch off momentarily when keys/wheel/slider are touched, and also when touch is removed. When the touch moves around the wheel/slider the LED will flicker on and off for the duration of the movement of the touch.

5 Troubleshooting

Problem	Potential Cause and Solution
Software will not communicate with the computer	▸ **Bad SPI or USB connection** Check that the USB cables are connected properly Check/replace cables Ensure that the E1106 assembly is getting power and the LED is on ▸ **See [1] below**
Software appears locked	▸ **Incorrect detection threshold** Change the detection threshold to a lower setting
Noisy or erratic signal	▸ **Noisy power supply** Try a different USB port or computer ▸ **Cables or E1106 assembly too close to strong noise source[1]** (such as a power line or switching noise source) Increase the distance between the E1106 assembly and the noise source Ensure that the grounded transparent backplate is in place on the E1106 assembly ▸ **E1106 assembly is not mechanically stable** Prevent E1106 assembly from moving around if the backplate is not fitted ▸ **Strong RFI from a transmitter or adjacent digital product** Remove the noise source or shield against it ▸ **USB cable connected via a USB hub** Connect the USB cable directly to the computer
QMagic Prox feature will not turn off	▸ Once activated it can only be deactivated by resetting the chip. This has to be done by physically unplugging the device.

NOTES:



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