Facilitating the use of touch sensor technologies in your board designs, Altium Designer provides support for creating planar capacitive sensor patterns on your PCB, for use with the range of Atmel® QTouch® and QMatrix® sensor controllers.

### Supported Self-Capacitance Type Sensors

The following self-capacitance type sensors are supported for use in your PCB designs:

- **Button (or key) sensor** (single channel)
- **Small spatially-interpolated slider** sensor (3 channels)
- **Small spatially-interpolated wheel** sensor (3 channels)
- **Medium spatially-interpolated slider** sensor (3 channels)
- **Medium spatially-interpolated wheel** sensor (3 channels)
- **Medium resistively-interpolated wheel** sensor (12 channels, only 3 connected to the sensor controller).

A button (or key) sensor is a *zero-dimensional* sensor. It has a single point of contact. Slider and wheel sensors are *one-dimensional* sensors – they detect movement of your finger along a single axis. A spatially-interpolated sensor uses the geometry of its electrodes to interpolate the electric fields. A resistively-interpolated sensor uses physical resistors to provide the interpolation.

Each channel (electrode) of these sensors has a single, direct connection to the sensor controller. Such sensors are non-directional, in terms of their emitted electric fields. Although they can be used with or without an overlying panel, electrostatic discharge (ESD) implications – for the associated controller device – is a major influence for such a panel being used.

All of these sensors are suited for use with Atmel QTouch sensor controllers.

### Supported Mutual-Capacitance Type Sensors

The following mutual-capacitance type sensors are supported for use in your PCB designs:

- **Button (or key) sensor** (single channel)
- **1-layer, small spatially-interpolated slider** sensor (n-channels)
- **1-layer, small spatially-interpolated wheel** sensor (n-channels)
- **2-layer, medium spatially-interpolated slider** sensor (n-channels)
- **2-layer, medium/large spatially-interpolated wheel** sensor (n-channels)
A button (or key) sensor is a zero-dimensional sensor. It has a single point of contact. Slider and wheel sensors are one-dimensional sensors - they detect movement of your finger along a single axis. A spatially-interpolated sensor uses the geometry of its electrodes to interpolate the electric fields. A resistively-interpolated sensor uses physical resistors to provide the interpolation.

Each of these sensors has X (transmit) and Y (receive) electrodes, with the mutual capacitance between X and Y measured by the sensor controller. For slider- and wheel-based sensors, multiple channels have unique X-electrode connections to the sensor controller, with a commoned Y-electrode connection. Such sensors should be used with an overlying panel, bonded with no air gaps. It is the panel that provides a suitable conduit for the electric fields between the X and Y electrodes.

All of these sensors are suited for use with Atmel QMatrix sensor controllers.

**Installing Atmel QTouch Touch Sensor Support**

If support has not already been added during initial installation of the software, it can be added from the Configure Platform page, when managing the extensions and updates for your installation (DXP » Extensions and Updates):

1. From the Installed page of the view, simply click the Configure button at the top-right - to access the Configure Platform page.

2. Scroll to the bottom of the page and enable the entry for Atmel QTouch, in the Touch Sensor
Support region of the page.

Then enable the Atmel QTouch option, under Touch Sensor Support.

3. Click the Apply button, back at the top-right of the page. Altium Designer must be restarted for the changes to take effect, so click Yes at the dialog prompt. The required files will be downloaded and installed, and Altium Designer restarted. Verify through Windows Explorer that the Atmel QTouch.IntLib is now available - in the \Users\Public\Documents\Altium\AD<VersionNumber>\Library\QTouch folder (for a default installation).

After the installation is updated, the Atmel QTouch integrated library will be available.

Sensor Implementation

A touch sensor is implemented in a design by placing and configuring the required sensor type from the dedicated Atmel QTouch integrated library (Atmel QTouch.IntLib).

The QTouch folder, and associated integrated library, will be present in the \Users\Public\Documents\Altium\AD<VersionNumber>\Library folder (for a default installation of Altium Designer), provided Atmel QTouch touch sensor support is installed as part of your Altium Designer installation, as detailed in the previous section.

When configured as required, simply update the target PCB – an ECO is used to effect the required
changes, resulting in the creation of the sensor pattern for placement on the PCB. Each sensor component on the PCB isn't a footprint in the normal sense, but rather the actual copper electrode pattern. An overlaying panel would be placed over a sensor when the board is assembled.

Implementing a touch control is a snap - just place the required sensor type component on the schematic, configure it as applicable to your design needs, then push the changes over to the PCB to obtain the sensor pattern.
A sensor pattern can also be modified on the PCB side, and the changes pushed back to the relevant schematic sheet through an ECO.

The following sections take a closer look at the configurable sensor components available for placement in a design, their configuration options, and the resulting sensor pattern obtained on the PCB side. In each case, the default configurations are presented.

As with all configurable schematic components in Altium Designer, access to the associated configuration dialog (QTouch Component dialog) for a sensor component is made by right-clicking over the component and choosing Configure from the context menu. Alternatively, click the Configure button from the associated properties dialog for the component.

**QTouchButton**

Use the QTouchButton component to implement a button (key) sensor. This is a self-capacitance, zero-dimensional sensor, with a single channel for connection directly to an Atmel QTouch sensor controller. The resulting sensor pattern on the PCB is a simple rectangular-shaped electrode.

![QTouchButton component](image)

Default configuration and resulting sensor pattern for the QTouchButton component.

**SmallQTouchSlider**

Use the SmallQTouchSlider component to implement a small-size slider sensor. This is a self-capacitance, 1-dimensional, spatially-interpolated sensor, with three channels for connection directly to an Atmel QTouch sensor controller. The resulting sensor pattern on the PCB is comprised of simple rectangular-shaped electrodes. The pattern consists of two full sized electrodes for channels 1 and 2, with channel 3 divided into two half-sized electrodes at either end.
**SmallQTouchWheel**

Use the SmallQTouchWheel component to implement a small-size wheel sensor. This is a self-capacitance, 1-dimensional, spatially-interpolated sensor, with three channels for connection directly to an Atmel QTouch sensor controller. The resulting sensor pattern on the PCB is comprised of simple wedge-shaped electrodes.

**MediumQTouchSlider**

Use the MediumQTouchSlider component to implement a medium-size slider sensor. This is a self-capacitance, 1-dimensional, spatially-interpolated sensor, with three channels for connection directly to an Atmel QTouch sensor controller. The resulting sensor pattern on the PCB is comprised of toothed electrodes. The pattern consists of two full sized electrodes for channels 1 and 2, with channel 3 divided into two half-sized electrodes at either end.
MediumQTouchSlider

Use the MediumQTouchSlider component to implement a medium-size wheel sensor. This is a self-capacitance, 1-dimensional, spatially-interpolated sensor, with three channels for connection directly to an Atmel QTouch sensor controller. The resulting sensor pattern on the PCB is comprised of toothed electrodes.

MediumQTouchWheel

Use the MediumQTouchWheel component to implement a medium-size wheel sensor. This is a self-capacitance, 1-dimensional, spatially-interpolated sensor, with three channels for connection directly to an Atmel QTouch sensor controller. The resulting sensor pattern on the PCB is comprised of toothed electrodes.

MediumResQTouchWheel

Use the MediumResQTouchWheel component to implement a medium-size wheel sensor. This is a self-capacitance, 1-dimensional, resistively-interpolated sensor, with three channels for connection directly to an Atmel QTouch sensor controller. The resulting sensor pattern on the PCB is comprised of wedge-shaped electrodes.
When configuring the sensor, you can choose how many electrode 'spacer segments' are used, equally, between channels. The default configuration uses 3 segments, resulting in 12 wedge-shaped X electrodes in the pattern. Remember that only 3 of these electrodes are connected back to the sensor controller. For this default configuration, the 3 channels connected to the sensor controller are associated with pins 1, 5 and 9 of the component.

To provide the electrically-driven interpolation of the sensors' electric fields, additional resistors must be used in the design, typically connecting a total of 100kOhms between successive channels that are connected to the controller (or 25kOhms between electrode segments). The following image shows an example of resistors wired to the sensor component to provide the required resistance levels, for the default component configuration.

QMatrixButton

Use the QMatrixButton component to implement a button (key) sensor. This is a mutual-capacitance, zero-dimensional sensor, with a single channel (one X and one Y electrode) for connection directly to an Atmel QMatrix sensor controller. The resulting sensor pattern on the PCB consists of interlocking fingers of the X and Y electrodes, in an overall rectangular shape. The Pattern for the X electrode completely surrounds that for the Y electrode.
Use the SmallQMatrixSlider component to implement a small-size slider sensor. This is a mutual-capacitance, 1-dimensional, spatially-interpolated sensor, with multiple channels for connection directly to an Atmel QMatrix sensor controller. The resulting sensor pattern on the PCB resembles a 1xn array of buttons, where n is the number of channels defined. X and Y electrodes again are implemented as interlocking fingers. There is a gap between each successive X electrode. The Y electrode is continuous (it is common to all channels), with an additional finger in this gap. Isolated regions of the same X electrode are connected using vias and a track placed on the opposite layer of the board.
**SmallQMatrixWheel**

Use the SmallQMatrixWheel component to implement a small-size wheel sensor. This is a mutual-capacitance, 1-dimensional, spatially-interpolated sensor, with multiple channels for connection directly to an Atmel QMatrix sensor controller. The resulting sensor pattern on the PCB resembles a 1xn circular array of buttons, where n is the number of channels defined. X and Y electrodes again are implemented as interlocking fingers, with tapering of the X-electrode fingers. There is a gap between each successive X electrode. The Y electrode is continuous (it is common to all channels), with an additional finger in this gap. Isolated regions of the same X electrode are connected using vias and a track placed on the opposite layer of the board.

![Diagram of SmallQMatrixWheel](image)

Default configuration and resulting sensor pattern for the SmallQMatrixWheel component.

**MediumQMatrixSlider**

Use the MediumQMatrixSlider component to implement a 2-layer medium-size slider sensor. This is a mutual-capacitance, 1-dimensional, spatially-interpolated sensor, with multiple channels for connection directly to an Atmel QMatrix sensor controller. The resulting sensor pattern on the PCB is composed of n slanting X electrodes, where n is the number of channels defined. There is a gap between each successive X electrode. The Y electrode is continuous (it is common to all channels) and consists of a number of horizontal 'fingers'. The Y electrode is located on the Top Layer, with the X electrodes located behind, on the Bottom Layer.

Each X electrode segment is 4mm in height. For a slider that is greater in height, additional segments are essentially stacked, in an alternating zig-zag fashion. An additional Y electrode finger is added for each level of segments in this stack. For the default configuration, where the height of the slider is 12mm, the stack incorporates three segments for each X electrode. The common Y electrode has three fingers.
Use the MediumLargeQMatrixWheel component to implement a 2-layer medium-size wheel sensor. This is a mutual-capacitance, 1-dimensional, spatially-interpolated sensor, with multiple channels for connection directly to an Atmel QMatrix sensor controller. The resulting sensor pattern on the PCB is composed of $n$ curved-tooth X electrodes, where $n$ is the number of channels defined. There is a gap between each successive X electrode. The Y electrode is continuous (it is common to all channels) and consists of a number of 'rings'. The Y electrode is located on the Top Layer, with the X electrodes located behind, on the Bottom Layer.

Each X electrode segment is radially 4mm in height. For a wheel that is greater in diameter, additional segments are essentially stacked, radially outward, in an alternating curved-tooth fashion. An additional Y electrode 'ring' is added for each level of segments in this stack. For the default configuration, where the inner diameter is 16mm and outer diameter is 40mm, the stack incorporates three segments for each X electrode. The common Y electrode has three rings accordingly.
**MediumResQMatrixWheel**

Use the MediumResQMatrixWheel component to implement a 2-layer medium-size wheel sensor. This is a mutual-capacitance, 1-dimensional, resistively-interpolated sensor, with multiple channels for connection directly to an Atmel QMatrix sensor controller. The resulting sensor pattern on the PCB is composed of n curved-tooth X electrodes, where n is the number of channels defined. There is a gap between each successive X electrode. The Y electrode is continuous (it is common to all channels) and consists of a number of 'rings'. The Y electrode is located on the Top Layer, with the X electrodes located behind, on the Bottom Layer.

Each X electrode segment is radially 4mm in height. For a wheel that is greater in diameter, additional segments are essentially stacked, radially outward, in an alternating curved-tooth fashion. An additional Y electrode 'ring' is added for each level of segments in this stack. For the default configuration, where the inner diameter is 7.5mm and outer diameter is 30mm, the stack incorporates three segments for each X electrode. The common Y electrode has three rings accordingly.

![Diagram](image1.png)

Default configuration and resulting sensor pattern for the MediumResQMatrixWheel component.

When configuring the sensor, you can choose how many electrode 'spacer segments' are used, equally, between channels. The default configuration 4 channels and uses 3 spacer segments, resulting in 16 curved-tooth X electrodes in the pattern. For this default configuration, the 4 channels connected to the sensor controller are associated with pins 1, 5, 9 and 13 of the component.

To provide the electrically-driven interpolation of the sensors' electric fields, additional resistors must be used in the design, typically connecting a total of between 2kOhms and 100kOhms between the n channels that are connected to the controller. The following image shows an example of resistors wired to the sensor component to provide the required resistance levels, for the default component configuration.
Example of resistors connected to the sensor component to provide the electrical interpolation for the sensor.

**Atmel Sensor Controllers**

Atmel QTouch and QMatrix sensor controllers - to which the corresponding electrodes from the sensor patterns connect - can be found on the [Atmel Touch Solutions](https://www.atmel.com) page within the [Unified Components](https://www.altium.com) section of the [Design Content](https://www.altium.com) area of the Altium Website.
Browse QTouch and QMatrix Controller components on the Altium Website.

Components can be browsed directly on these pages. In addition, each page offers the following two options:

- **Go To Vault** - click this button to browse the components through the browser-based interface to the Altium Content Vault in which the components reside.
- **Download Library** - click this button to download the components in a zipped integrated library file.

Alternatively, connect to the Altium Content Vault through Altium Designer and place components directly into your designs.

To connect to the vault, simply access the [Data Management – Vaults page](#) of the
Preferences dialog, and click the Add Altium Content Vault button. Provided you have a licensed instance of Altium Designer and valid Altium Subscription, a connection to the vault will be made instantly. This direct connection enables you to access and place content from the Altium Content Vault directly into your designs, through the Vaults panel.

The QTouch and QMatrix Controllers can be found in the Unified Components\Components\Atmel\Touch Solutions vault folder.

Further Information


Source URL: https://www.altium.com/documentation/display/ADES/(Atmel+Touch+Controls)_AD