The AT42QT101x single key capacitive touch controller family provide touch key replacements for mechanical buttons. The ICs are low cost, and as such can be added to designs with minimal impact on the bill of materials.

Each Device has Different Operation:

- **AT42QT1010 (QT1010)**
  Single key with timer to reset “stuck key” condition.
- **AT42QT1011 (QT1011)**
  Single key with no reset timer.
- **AT42QT1012 (QT1012)**
  Single key with touch-on/touch off or “toggle” operation and power down timer

The Devices have the following Features in Common

- 2.9 mm x 1.6 mm SOT-23 package
- Low power consumption (17 µA at 1.8V)
- Low cost
- Easy to implement
- Range of response speed settings
- Can be configured for use as a proximity sensor
**AT42QT1010 and AT42QT1011**

The AT42QT1010 and AT42QT1011 are identical apart from their behavior when the sensor is “in detect” for an extended period.

The AT42QT1010 has a “maximum on” duration of ~ 60s. If there is an obstruction on the sensor, the device output will go low after the “maximum on” detection period, so that subsequent touches can be detected.

The AT42QT1011 has no timer and the device will remain on whilst the sensor is activate.

**Speed Settings**

The AT42QT1010 and AT42QT1011 have three speed settings:

- For devices where a quick response is required, a fast response setting is available with a 12.2 ms maximum response time.
- It is also possible to set up the device for low power consumption, at the expense of a slower response time of up to 88.6 ms.
- A third option is to synchronize the device to an external clock which makes it possible to synchronize several ICs in the same device. This technique can be used to enhance noise immunity by syncing to a noise source such as mains. The response time is then dependent on the external clock.

When the device is in low power mode or when the synchronisation mode is selected, a HeartBeat™ output is available. This provides a pulse whilst the device isn’t in detect which can be used to verify the device is working correctly.

**AT42QT1012**

The device is similar to the AT42QT1010 and AT42QT1011 but it has touch-on/touch-off (toggle) functionality and a power down timer.

**Auto Off Timers**

The QT1012 has a number of options for automatic power down which can be used to conserve power in situations where the device could be left on inadvertently. There are predefined power down settings which can be used to power the device down after 15 minutes or 60 minutes. There is also the option for no power down timer so the device remains on until touched again.

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### Single-Key Touch Controllers

<table>
<thead>
<tr>
<th>AT42QT1010</th>
<th>AT42QT1011</th>
<th>AT42QT1012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single button or proximity sensor</td>
<td>Single button or proximity sensor</td>
<td>Single button or proximity sensor</td>
</tr>
<tr>
<td>Prolonged touch timeout after 60 seconds</td>
<td>No power down, remains active while touch present</td>
<td>Toggle (touch on/off) functionality</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Power down after configurable time period</td>
</tr>
</tbody>
</table>
Standard Features
The following functionality is common to all three ICs in the AT42QT101X family.

Drift Compensation
Drift compensation algorithms constantly adjust the reference level in the device to ensure that the key will remain calibrated even if there is a large change in background capacitance.

Spread Spectrum Acquisition
The devices modulate their frequency whilst measurements are taken. This has the effect of reducing emission levels and susceptibility to interference as there is no single burst frequency.

Power Consumption
All the devices have a range of power modes depending on the response time required. The power consumption is kept to a minimum whatever power mode the device is in. This, combined with the auto-off functionality available on the QT1012 means that for portable devices, adding capacitive sensing functionality does not significantly impact on the battery lifetime.

Sensitivity
By careful capacitor selection and key design, the sensitivity of a capacitive button can be set to work with a wide range of panel thicknesses and materials. As the sensitivity of the key can be varied significantly it is also possible to use any of the single key devices as proximity sensors. Such functionality can be used in toys or used to illuminate “hidden until lit” user interfaces.

Calibration
The device will automatically calibrate on power up. If there is an obstruction on the key for a prolonged period, the sensor will re-calibrate after a set time period (with the exception of the QT1011, which will indicate a touch condition as long as the sensor is “in detect”). This ensures that the device will detect a new touch correctly.

Detection
In order for the sensors to only go active on intended touches, the ICs include signal processing which helps to suppress detections caused by electrical noise and quick brushes with the surface.

Typical Applications
- Power switches
- Hearing aids
- Isolated buttons/sensors
- Children’s toy
- Timers
- Proximity sensors
Specifications

### System

<table>
<thead>
<tr>
<th>Feature</th>
<th>AT42QT1010</th>
<th>AT42QT1011</th>
<th>AT42QT1012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Keys</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Number of I/O lines</td>
<td>1 output channel</td>
<td>1 output channel</td>
<td>1 output channel</td>
</tr>
<tr>
<td>Key outline sizes</td>
<td>6 mm x 6 mm recommended or arbitrary shape</td>
<td>6 mm x 6 mm recommended or arbitrary shape</td>
<td>6 mm x 6 mm recommended or arbitrary shape</td>
</tr>
<tr>
<td>Signal processing</td>
<td>Noise filtering, self calibration on startup, automatic drift compensation</td>
<td>Noise filtering, self calibration on startup, automatic drift compensation</td>
<td>Noise filtering, self calibration on startup, automatic drift compensation</td>
</tr>
</tbody>
</table>

### Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>AT42QT1010</th>
<th>AT42QT1011</th>
<th>AT42QT1012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Supply</td>
<td>1.8V-5.5V</td>
<td>1.8V-5.5V</td>
<td>1.8V-5.5V</td>
</tr>
<tr>
<td>Power Supply Ripple + Noise</td>
<td>20 mV</td>
<td>20 mV</td>
<td>20 mV</td>
</tr>
</tbody>
</table>

### Environmental Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>AT42QT1010</th>
<th>AT42QT1011</th>
<th>AT42QT1012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>-40 to 85°C</td>
<td>-40 to 85°C</td>
<td>-40 to 85°C</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>-65 to 150°C</td>
<td>-65 to 150°C</td>
<td>-65 to 150°C</td>
</tr>
</tbody>
</table>

### DC Specifications

<table>
<thead>
<tr>
<th>Condition</th>
<th>AT42QT1010</th>
<th>AT42QT1011</th>
<th>AT42QT1012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Current (Slow mode)</td>
<td>17 µA</td>
<td>17 µA</td>
<td>31.5 µA</td>
</tr>
<tr>
<td>Supply Current (Fast mode)</td>
<td>219 µA (1.8V Supply Current)</td>
<td>219 µA (1.8V Supply Current)</td>
<td>N/A</td>
</tr>
</tbody>
</table>

### Package Options

<table>
<thead>
<tr>
<th>Package Options</th>
<th>AT42QT1010</th>
<th>AT42QT1011</th>
<th>AT42QT1012</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-pin</td>
<td>2.9 mm x 1.6 mm SOT-23</td>
<td>2.9 mm x 1.6 mm SOT-23</td>
<td>2.9 mm x 1.6 mm SOT-23</td>
</tr>
</tbody>
</table>

Visit [http://www.atmel.com/singletouch](http://www.atmel.com/singletouch) for more information

http://www.atmel.com/touch

Device selection guides, Datasheets, Application Notes, Tools, Software