Button, Slider, & Wheel Solutions

“Where there’s a button, there’s an opportunity!”
Agenda

• User Interface Types
• Touch Solutions Overview
• Capacitive Touch Sense Methods
• Charge Transfer Technology
  • Self Capacitance
  • Mutual Capacitance
  • Proximity
  • Slider and Rotor Design
• QTouch – Buttons, Sliders, Wheels
  • QTouch Application Specific Products
  • QTouch Library
  • Altium Designer Support
  • Hardware Tools
• Touchscreens
User Interface Types

• Mechanical
  • Most common for buttons & sliders
  • Prone to wear & breakage

• Resistive
  • Moving surface - prone to wear & breakage

• Inductive
  • Moving surface – prone to wear & breakage
  • Expensive & inflexible

• Optical
  • Infrared is commonly used – sensitive to sunlight
  • Expensive and unreliable

• Surface Acoustic Wave
  • Complex to design & expensive

• Capacitive
  • Buttons, sliders directly implemented on PCB
  • Flexible sensor size & shape
  • Low system cost

☆ Capacitive – Easy to implement, flexible, cost effective
Capacitive Sensing: Revolutionizing Product Design

• Reliable & Durable User Interface
  • No mechanical wear
  • Closed to environment
  • Excellent button/switch replacement

• Innovative
  • Greater flexibility in industrial design
  • Differentiates end product

• Flexible
  • Buttons & Proximity Sensors
  • Sliders & Wheels
  • Touchpads & Touchscreens
  • Haptics
Capacitive Touch Sense Methods

- R/C charge/discharge
- Capacitive measurement via Sigma-Delta modulator (C/D converter)
- Relaxation oscillator method
- Current source voltage ramp timing
- Switched reactance technology
- Sine wave measurement
- Charge transfer technology.
Atmel Touch Solutions

**Atmel Touch Solutions**

- **Button, Slider, & Wheel**
  - Application Specific ("ready-to-use")
  - 1 – 48 Channels
  - Buttons, Proximity & Sliders
  - Self- & Mutual- Capacitance
  - No programming required
  - Limited Flexibility

- **Touch Software**
  - Add touch functionality to your general purpose Atmel MCU
  - 1 – 64+ Channels
  - Buttons, Proximity & Sliders
  - Self- & Mutual- Capacitance
  - Fully programmable
  - Excellent Flexibility
  - Excellent Integration

- **Touchscreen**
  - Revolutionary Unlimited Touchscreen Technology
  - Single-Touch & Dual-Touch devices also offered

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QA Touch

QC Touch library

maXTouch™
Self Capacitance: Basics

- Electrode is a single conductive plate
- 2nd plate of capacitor is circuit or earth ground
- The sense electrode is just an “open circuit” pad in other words we measure the “self capacitance” of this pad
- Electrode is behind a dielectric panel so no direct galvanic connection to measuring circuit when touched
- Goal: Detect finger presence near electrode
- The finger is detected because of the effect that its presence has on the capacitance of the electrode.
- QTouch uses a patented charge transfer process to measure the capacitance of the electrode and so determine whether there is a finger near the electrode or not.
Self-Capacitance: Equivalent circuit

- GND is the PCB ground
- EARTH is earth ground
- Assume $C_s >> C_x$, and $C_f >> C_x & C_t$
- → $C_x$ and $C_t$ are of interest for us
- Increasing $C_s$ = Increased differential sensitivity and makes the burst length longer → Improves resolution

$C_s$ Sampling capacitor (1-100nF)

$C_x$ Electrode capacitance to earth (2-10pF)

$C_f$ (coupling capacitance between circuit GND and earth (few Pf))
**Self Capacitance: Charge Transfer Basics**

- Uses a switched capacitor method, employing a “sampling” capacitor Cs.

- Cs is switched using the micro’s IO pins using firmware “bit banging”, with the two ends of Cs transitioning between low, high states in a fixed sequence.

- The switching sequence generates a series of voltage pulses which cause current to flow in Cs and Cx (in series with each other).

- The voltage on Cs builds up pulse-by-pulse until it registers a logic ‘1’ on the IO pin.

  ![Diagram](image.png)

  **The number of pulses to reach this logic state is our measurement**
Self-Capacitance: Touch vs. No-Touch

What happens during a touch?

- Ct added in parallel to Cx.
- Each charge pulse now charges Ct and Cx
- Charge builds up in Cs more quickly
- As each pulse deposits more charge, Vcs rises faster. So:
  - we reach Vih more rapidly
  - we need fewer pulses
  - burst time gets shorter
  - burst change (delta) is proportional to Ct

→ When Delta reaches its threshold a touch is detected.
Sliders and Wheels

- Linear touch
- Rotary touch
- 3 channels
- High resolution
Sliders and Wheels - Easy scrolling

- Usable over LCD display
- iPod-type functionality
- Low voltage, low power
- Only three channels used to make a 256 position absolute scroller

Sliders and Wheels - Easy scrolling

Sliders are popular in personal media devices
Get Atmel’s Robust Touch Technology

Why using capacitive touch?

• Advantages
  • Better wear out - Increase your product life time
    → Atmel’s Touch operates through 6mm glass or similar non conductive
  • Hermetically sealed devices
    → Atmel’s MCUs dissipate less temperature
  • Immunity to water / moisture / dust
    → Atmel’s Qmatrix charge transfer technology
  • Reduce your cost
    → Integrate the touch detection on your Atmel MCU using the free-of-charge Qtouch library

• Inhibitors
  • Missing tactile feedback
    → Visual or audio feedback can be used
  • Detection when using gloves
    → Atmel’s Touch has an high Signal-to-Noise ratio enabling the usage of gloves
  • Electrical Magnetic Interferences
    → Atmel’s Touch implement spread spectrum frequency
Atmel Solution Advantages

• **Technological Advantages**
  • Adjacent Key Suppression™ (AKS)
  • Failure Mode detection (FMEA)
  • Automatic and frequent calibration
  • Ultra low power operation (down to 1.8V)
  • Works very well in inductive systems
  • Single layer PCB
  • Industry’s best EMC and EMI behavior
    • Best-in-industry noise immunity
    • Spread Spectrum Modulation yields low radiated power
  • Industry’s best field penetration
    • Sense through thick materials
    • Excellent proximity sensing range

• **Reliability Advantages**
  • Tolerates contamination
  • Works in presence of moisture
  • Automatically compensates for temperature, humidity, voltage changes, and aging of components
  • No production calibration needed

• **Industry’s easiest to use development tools**
  • QTouch Studio that supports the complete design flow

• **Industry’s broadest portfolio of solutions**
  • Touch Application Specific devices
  • Touch functionality integrated in MCU devices using QTouch Library
  • Industry’s highest performance MCU for touch applications
Differentiating Atmel Touch Sensors

- Atmel technology generally gives a very high signal:noise – makes designs easier from the outset, even with small sensors & noisy environments
- Atmel technology allows broad range of key sizes & shapes due to size of integration capacitors & flexibility of technology
- Strong suppression of moisture effects using QMatrix due to X and Y electrode design and touch acquisition
- QMatrix allows remote placement of chip – no ‘active’ sensor lines
- Atmel chips generally have sufficient processing power – more of chip resource remains for other applications after touch sensing is complete
  - Generally leads to lower power consumption
  - Broader range of applications addressable with a lower cost chip
- Key patent for close pitched key arrays - Adjacent Key Suppression (AKS™)
QT Application Specific Device Roadmap

# of Channels

- 56
- 48
- 32
- 24
- 16
- 15
- 14
- 11
- 10
- 8
- 7
- 6
- 4
- 1

NOW

1040
1060
1110
1111
1070
1060
1061
1040
1010
1011
1012

FMEA / EN60730
Home Appliances

Optimized Architecture

Slider / Wheel

Slider / Wheel

Haptics

In Development
Available
QTouch vs. QMatrix

QTouch
• Self-Capacitance
  • Robust and simple electrode design
  • Ideal for low node count
  • Good proximity, providing better sensing distance
  • Virtually any electrode shape possible
  • Easy to tune sensitivity
  • Uses no peripherals like timers or ADCs

QMatrix
• Mutual-Capacitance
  • Well defined key area for detection
  • Ideal for high note count (>10 nodes)
  • Very resilient to moisture & environment
  • Passive tracking – longer tracks possible
  • Very resilient to noise and ground loading
    • Flooded X design
  • Uses the ADCMUX and one Timer/Counter
Tools
What is the QTouch Library™?

• Free software library
  • Linkable object files for Atmel 8-bit & 32-bit MCU families
  • Common API
• Integrates touch capabilities in Atmel MCUs
  • 8-bit MCUs
    • tinyAVR
    • megaAVR
    • XMEGA
  • 32-bit MCUs
    • UC3 (32-bit AVR)
    • ARM (ARM CortexM3)
• Enhances integration, control & flexibility
Atmel Touch Software Library - Flexible

• Available on standard Atmel parts using libraries
• Environmental changes tracked and compensated
• Error conditions detected and corrected
• Works seamlessly with main device application
AVR QTouch Studio
**QTouch Studio: Easy to Use**

- Individual settings can be changed in-system
- Touch quality analyzer
  - Signal-to-noise ratio, absolute noise, drift, ...
- Design Validation
  - Problem solver wizard
  - Auto-tuning – automatically finds best settings
- Capacitance data view & graphical tuning
- Touch interface visualization
  - User can import image of product
  - Place sensors on top of user image
  - Select and scale sensor patterns using menus
  - Configure sensor settings & parameters
  - Generate sensor initialization code
- Development kit support
- Device configuration tool
The QTouch Studio Vision

• Stages in the customers Touch design:
  1. The analysis phase
     ▪ Analyze if the required design can be done using QTouch technology
  2. The evaluation phase
     ▪ Use evaluation kits to demonstrate and evaluate QTouch
  3. The design phase
     ▪ Use QTouch Studio and CAD tools to design the Touch interface HW
     ▪ Use the code generator to set up the QTLib
     ▪ Use AVR Studio to design the complete firmware
  4. The touch debug phase
     ▪ Use QTouch Studio to analyze touch performance
     ▪ Use QTouch Studio to analyze the coexistence of QTLib and user FW
  5. The validation phase
     ▪ Use QTouch Studio to validate proper and reliable touch performance
  6. The production phase
     ▪ Use QTouch Studio to validate a production lot
For a complete list of supported devices:

- QTouch Library User Guide
- www.atmel.com/QTouchLib
QT600: What’s in the Box?

- Evaluation and Development Kit
- Ordering Code: ATQT600
- MSRP: US$199

3 Sensor boards
- 8 channel QTouch board
- 16 channel QTouch board
- 64 channel QMatrix board

3 MCU boards
- ATtiny88 (QTouch)
- ATmega324PA (QMatrix)
- ATxmega128A1 (QTouch)

Interface board
- 2-way debug data
- ISP Programmer
- Supports AVR / AVR32
QTouch Xplained

- Evaluation Kit
  - Requires AVR Xplain board (sold separately)
- Supported by QTouch Library
- Supported by QTouch Studio
- 8 channel QTouch Solution
  - 2 buttons
  - 1 slider
  - 1 wheel
Single-Channel AT42QT1010/1011/1012

- 1 touch key with discrete output
- QTouch acquisition method
- Proximity Sensor supported
- Low Power: 17uA at 1.8V
- Small Package: 6-pin SOT-23 (2.9 x 1.6mm)
- Configurable Sleep Time & Toggle Output device options

Target Applications/Markets:
- Power Buttons
- System Wakeup
- Hearing Aids
- Bluetooth Headset
- Proximity Sensors
- Mechanical Switch Replacement
- Portable Consumer Devices
- Toys

- Datasheets: NOW
- Samples: NOW
- Mass Production: NOW
- Evaluation Kits: EVK1010A, EVK1012A NOW
11-Channel AT42QT1110/1111

- 11 touch keys with discrete outputs or SPI comm
- QTouch acquisition method
- Proximity Sensor supported
- Automotive, Industrial & Low-Power device options
  - AT42QT1110-AZ/MZ: Automotive device, 3.0 — 5.5V, -40 — +125°C, AEC-Q100
  - AT42QT1110-AU/MU: Industrial device, 3.0 — 5.5V, -40 — +85°C
  - AT42QT1111-AU/MU: Low-power device, 1.8 — 5.5V, -40 — +85°C
- Device configuration stored in EEPROM
- Target Applications/Markets:
  - Consumer Products
  - Industrial Switch Panels
  - Automotive Control Panels
  - TVs & Monitors
  - Portable Media Players
  - Home Appliances
  - Printers
  - Set Top Boxes
- Datasheets: NOW
- Samples: NOW
- Mass Production: Now
- Evaluation Kits: EVK1110A, EVK1111A
16-Channel AT42QT2161

- Smooth PWM version of AT42QT2160 (devices are pin-compatible)
- 16 touch keys with I2C slave comm interface
- QTouch acquisition method
- Supports Slider
- Target Applications/Markets:
  - Consumer Products
  - Industrial Switch Panels
  - TVs & Monitors
  - Portable Media Players
  - Printers
  - Set Top Boxes
- Datasheet: Now
- Samples: Now
- Mass Production: Now
- Evaluation Kits: None (use EVK2160A)
7-Channel AT42QT1070

- 7 touch keys with I2C comm
- QTouch acquisition method
- Proximity Sensor supported (with increased range)
- 1 pin / channel & no external components
- Low sensitivity to Vcc fluctuation
- Hardware PWMs support LED dimming
- Target Applications/Markets:
  - Consumer Products
  - Industrial Switch Panels
  - TVs & Monitors
  - Portable Media Players
  - Printers
  - Set Top Boxes

- Datasheet: Now
- Samples: Now
- Mass Production: Now
- Evaluation Kits: EVK1070A
**ATtiny10**

- **ATtiny10**
  - 1K Flash, 32B SRAM, 6 pins
  - 1 QTouch channel
  - 6-pin SOT-23 package
  - Samples / MP: NOW
  - Eval kit: August 2010 (ATtiny10-EK1)
  - Configurator tool included in QTouch Studio 4.3

- **Features & Functionality**
  - HW support for QTouch
  - 4 GPIO
  - 4 Channel 8-bit ADC
  - Rail-to-Rail Analog Comparator
  - 16-bit T/C with Prescaler and two PWM Outputs
  - 12 MHz Internal Calibrated RC Oscillator
  - Touch Apps
    - Hearing aids
    - Wireless headsets
    - Button replacement (gaming, toys, etc.)
ATtiny20 & ATtiny40

• ATtiny20
  • 2K Flash, 128B SRAM, 14 pins
  • Up to 7 QTouch channels
  • 3x3mm QFN14 package
  • Samples / MP: NOW
  • Eval kit: Now (ATtiny20-EK1)
  • Touch support included in QTouch Library 4.3

• ATtiny40
  • 4K Flash, 256B SRAM, 20 pins
  • Up to 14 QTouch channels
  • 3x3mm VQFN20 package
  • Samples: NOW
  • MP: Now
  • Eval kit: Now (module for QT600)
  • Touch support included in QTouch Library 4.3

• Features & Functionality
  • HW support for QTouch
    • One pin per capacitive channel
    • No external components
    • 12/18 GPIO
    • 8/12 Channel 10-bit ADC
    • Rail-to-Rail Analog Comparator
    • 8-bit T/C with Prescaler and two PWM Outputs
    • 16-bit T/C with Prescaler and two PWM Outputs
    • 12 MHz Internal Calibrated RC Oscillator
    • Hardware I2C Slave
    • Touch Apps
      • Control panels (printer, security & energy, etc.)
      • TVs & Monitors
Automated PCB Design in

*Altium Designer*
Atmel QMatrix™ Touch Sensor Design

- Design rules affect performance
  - Power consumption
  - Signal-to-noise ratio
  - Sensitivity
- Design rules documented in:
  - Design guides
  - Application notes
  - Reference designs
- Manual design is time consuming

**Figure 6-2. One-layer Small Wheel (Spatially Interpolated)**

The sensor design for a wheel is essentially the same as that for the slider, but the array of keys are arranged in a circular form (see Figure 6-2) and there is no end border. This design can be used for wheels from 15 mm to 21 mm in diameter that are constructed with at least 6 keys. Note that the X fingers taper to Yend or slightly greater (not sharp points), and this tapering determines the inner diameter of the wheel.

As with the slider, you will need to calculate the number of X fingers for the wheel. However, as there is no end border, xend is not calculated and any unallocated width remaining after the number of fingers has been calculated is distributed equally across the X fingers.

To design the wheel:
1. Decide on the diameter (D) of the wheel (15 mm to 21 mm).
2. Check that the outer arc (W) of each key in the wheel is between 6 and 8 mm:
   - W ≤ (8 / keys) \times \text{Yend}
   - If W is < 6 mm, then consider doing one of the following:
     - Break the wheel into fewer keys
     - Make the diameter of the wheel larger
   - If W > 8 mm, then consider doing one of the following:
     - Break the wheel into more keys (if the controller supports more keys)
     - Make the diameter of the wheel smaller
   - Use a resistively interpolated design to artificially break the wheel into smaller pieces (see Section 6.4 “Typical Resistively Interpolated Method” on page 6-10)
QMatrix™ Wheel Example

• A complex QMatrix™ wheel
• Design time: ~3 days
• Any changes will cause a complete redesign
• Imagine if CAD tools could do this automatically...
Altium™ Automated QTouch® PCB Design

• Introducing sensor pattern generator – draws shapes automatically

• Generates any touch sensor fully compliant with design rules
  • Only dimensions & overlay thickness needed
  • QTouch® and QMatrix™ patterns generated automatically per specification
Configuration in Schematic

• Touch Elements are treated as “Configurable Components”
• Can be configured in Schematic & PCB
• Visible changes in symbol representation done automatically
Re-Configuration in PCB-Layout

• If required, re-configuration can be done in seconds
• Same configuration dialog-boxes in schematic & layout
Implementation at a Glance

• Physical representation of Touch-Elements is calculated & created:
  • Based on given parameters
  • During forward-annotation process

• No physical library (footprints) behind the scenes

• Forward-/Backward-annotation maintains changes between Schematic & PCB
Touch Button Examples

[Images of various touch button examples]
Wheels and Sliders Applications
Atmel’s Touch HMI

- **Customer needs:**
  - Vandalism safe and waterproof, touch iUI
  - 3.4" OLED Display 480x272

- **Customer benefits:**
  - Atmel System Solution SAM9261 + QT60160
  - Easy and fast software development
  - .Net Micro Framework (available on SAM9261)
  - Using .NET made using the QT a snap (200 lines code size driver done in a day)
  - ClickTouch ITO : very experienced with QT and ITO technology

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[YouTube Video](http://www.youtube.com/watch?v=2wc2lX6zF5c)
Touchscreen

Single, Dual, Multi-Touch Solutions
Atmel Touch Solutions

Buttons, Sliders, Wheels

- Application Specific ("ready-to-use")
  - 1 - 48 Channels
  - Buttons, Proximity, & Sliders
  - Self- & Mutual- Capacitance
  - No programming required
  - Limited Flexibility

Touch Software

- Add touch functionality to your general purpose Atmel MCU
  - 1 - 64 Channels
  - Buttons, Proximity, & Sliders
  - Self- & Mutual- Capacitance
  - Fully programmable
  - Excellent Flexibility
  - Excellent Integration

Touchscreens

- Revolutionary Unlimited Touchscreen Technology
- Single-Touch & Dual-Touch devices also offered
Current and Future Large Screen Markets

Desktop Monitors/AIO/Kiosks

AIO computers is an established form factor

PC Notebooks/ Cash Register

Convertible slate perfect form-factor for touchscreen App

Tablets/ Netbook/POS

Tablets- on a high growth trajectory

Netbooks shrinking as Tablets growing

Tablets- on a high growth trajectory

E-Reader growing but cost-sensitive

E-Reader growing but cost-sensitive

Diagonal screen size (inches)

mXT1386/616, mXT768E/540E/384E, mXT224E

mXT1386/616, mXT768E/540E/384E, mXT224E

mXT1386/616, mXT768E/540E/384E, mXT224E

mXT768E/540E/384E, mXT224E

mXT768E/540E/384E, mXT224E

kindle DX

ALL NEW E-INK SCREEN
50% BETTER CONTRAST
FREE 3G WIRELESS

Next Gen Architecture (15-25”)

Single Chip Tablet Solution (10”-17”)

Convertible slate perfect form-factor for touchscreen App

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What is a Capacitive Touchscreen?

Several elements work together to create touch interface............. all of which must work in harmony.

- **Display** – several types, with different characteristics
- **Cover lens**, hardened glass or plastic
- **A sensor** made from transparent conductive material - ITO
- **Capacitive touch IC (on tail or main board)**
- **Includes touch sensing firmware**
- **Connection between sensor and driver chip - Tail**

Seeing further integration – more pressure on system
Touchscreen Construction

1mm Glass Lens

Flex PCB Tail

Hot Bond

Decoupling Capacitors

mXT224 Chip - can be on tail or main board

ZIF Connector

USB Connector

ITO Sensor Area (Glass or PET film)
State of the Art Technology

**maxTouch™**

Optimized hardware and software solution
Mutual Capacitance vs. Self Capacitance

**Self Capacitance**
- Each X and Y line is pulsed/sensed in turn
- Two fingers on one line gives the same result as one finger
- There is ambiguity of touch point ‘ghost’ positions
- Some level of correction possible in software

**Mutual Capacitance**
- Each X line is pulsed in turn
- Y lines are scanned for a change in capacitance
- Each ‘node’ (XY intersection) on the screen is individually addressed
- All touch points on the screen are unambiguously sensed

Atmel’s QMatrix is a mutual-capacitance method

Result: $X_2 \times Y_0 = 1$
$X_1 \times Y_3 = 1$

Conclusion: $X_2,Y_0 = 1$
$X_1,Y_3 = 1$

Result: $X_3 \& X_0 = 0$
$X_2 \& X_1 = 1$
$Y_0 \& Y_3 = 1$
$Y_1 \& Y_2 = 0$

Conclusion: $X_3,Y_0 = 1$
$X_2,Y_3 = 1$
$X_1,Y_0 = 1$
$X_1,Y_3 = 1$

$4 \times 4 = 16$ sensors

$4 + 4 = 8$ sensors
# Features and Benefits

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unlimited, unambiguous touch identification, tracking and reporting</td>
<td>• Multi-touch gesture support – pinch, stretch, etc.</td>
</tr>
<tr>
<td></td>
<td>• Classifying and rejecting unintended touch – a major value of multi-touch</td>
</tr>
<tr>
<td>Low current consumption</td>
<td>• Used on portable devices with low impact on battery lifetime</td>
</tr>
<tr>
<td>• &lt;1.8 mW idle, &lt;4mW touched</td>
<td></td>
</tr>
<tr>
<td>Highly Responsive</td>
<td>• Future-proof and ideal for use with the most demanding applications such as gaming</td>
</tr>
<tr>
<td>• Time to first touch &lt;10 ms from idle</td>
<td></td>
</tr>
<tr>
<td>Smart Processing</td>
<td>• Touchscreen can be gripped enabling unencumbered use of the remainder of the screen</td>
</tr>
<tr>
<td>• Grip suppression</td>
<td>• Facial touches ignored when in call</td>
</tr>
<tr>
<td>• Facial suppression</td>
<td></td>
</tr>
<tr>
<td>High Signal to Noise Ratio, SNR (80:1)</td>
<td>• Fingertip, back of finger touches supported</td>
</tr>
<tr>
<td>Wiring is not touch sensitive / “hot”</td>
<td>• Chip can be placed on main PCB or an active tail can be used where the chip is on the flex</td>
</tr>
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</tbody>
</table>
**Touchscreen Supply Chain**

Many new entrants, but integration occurring

- **Sensor IC**
- **Design** → **Foundry**
- **ITO glass/film**
- **Material** → **Processing**
- **Cover Lens**
- **Glass** → **Processing**

Atmel partners

**Touch panel module assembly**

**ODM /EMS**

**OEM**

Atmel partners

**LCD components**

**LCD Display**

Atmel partners
Atmel Partner Ecosystem

Atmel have a wide range of partners, providing flexibility to customers.

Module and LCD

- Sony LCD JP
- AUO TW
- TPO TW
- SMD KOR
- Data Modul EUR
- Wintek TW
- Nissha JP
- Alps JP

ITO on Glass

- AUO TW
- TPK TW
- LG Display KOR
- Sintek TW
- Cando TW

ITO on PET

- Nissha Japan
- YFO TW
- ELK KOR
- JTouch TW
- Gunze JP
- Sheldahl USA
- Ocular USA
- Touch I’ntl TW
- Luxe TW
- Cando TW
What are the Requirements of a Touchscreen?

**Works well with the display**
- Transparent
- Noise immune

**Excellent usability**
- Accurate
- Responsive
- Robust

**Easy and flexible implementation**
- Configurable
- Screen + Button combinations

**Easy system integration**
- Low power
- Noise immune
- Small
European Module Partners

- Data Module
  - Munich
  - 5k-250k opps

- TRS International GmbH
  - Munich
  - 5-250k opps

- Coastform Systems Ltd
  - UK
  - 5k-100k opps

- Touchnetix Ltd
  - UK
  - 5k-100k opps
North American Module Partners

TouchSensor Technologies, LLC
- Illinois

Ocular®
- Texas

Touch International
- Texas
• Low Visibility ITO
  – Unique design that virtually eliminates the visible ITO traces
  – Enables Crystal Touch improved viewability
  – Especially important for large touch panels
• Released up to 15.6” Crystal Touch panel
Summary

• #1 in Performance
  • Best signal-to-noise ratio (SNR) = Best reliability
  • Highest performance, low power MCU core
  • Broadest touch solution portfolio

• #1 in Innovation
  • New solutions planned throughout 2010 & 2011
  • Best performing multi-touch touchscreen solution on the market
  • QTouch Library support for all Atmel MCU devices

• #1 in Support
  • Deepest application expertise (>14 years in market)
  • Creation of broadest library of design guides, application notes, etc.
  • Easiest to use tools in the industry
Technical Support

• Worldwide technical support team
  • Asia
  • Europe
  • USA
For ARM
at91support@atmel.com
For AVR
Hotline.avr@atmel.com
For Touch solutions:
touch@atmel.com

• MCU Support Center
  • Submit requests on Atmel Web site support center
  • eJournal tracking system
  • Customer can track the status of his requests
  • Centralization of all requests allows use of worldwide support resources
  • Warning for documentation updates
Thank you