New 8FX MCU family
TSC MCU (MB95870 series)
Product Introduction

Fujitsu semiconductor (Shanghai) Co., Ltd
June. 2012
Fujitsu New 8FX MCU Roadmap
## New 8FX MCU Portfolio

### 0.35um

<table>
<thead>
<tr>
<th>8bit MCU Line Up</th>
<th>CY 2011</th>
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### 0.18um

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<td>8pin MB95F618</td>
<td>MB95F876/866/856</td>
<td>MB95F876/866/856 Touch MCU</td>
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<td>8com LCDC</td>
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*New 8FX MCU Portfolio for CY 2011 and CY 2012.*
TSC MCU Overview
2 in 1 TSC MCU – A Revolution

MCU
For main control

TSC chip
For touch interface

MB95870 series

MCU
TSC Chip

Evolution
TSC MCU Overview

Typical Applications

Single Keys
- Output information: Which key has been touched
- MCU no need to process the touch data
- MCU loading 0%

Advanced sensing (slide, wheel, approximation etc.)
- Output information: Touch strength
- MCU needs to process the touch data
- MCU loading 1%

MCU
F2MC-8FX
MB95F870
MB95F860
MB95F850

Digital H/W TSC

CH1
CH2
CH3
CH4
CH5
CH6
CH7
CH12

Slider
Buttons

Wheel
Touch Sensing Human Input

- Touch Sensing – a revolution in Human Input Device
  - Can replace virtually all mechanical buttons, sliders and turning nobs
  - Create a simple, robust, clean and esthetic design

\[ C_{Touch} = \varepsilon \frac{A}{D} \]

- \( C_{Touch} \): The capacitance induced between finger and touch pad when touched.
- \( \varepsilon \): The constant value of permittivity (Air=1, Glass=10, Acryl=5~10, rubber=2~3)
- \( D \): The thickness of Set Cover
- \( A \): The size of Touch Pad
How does TSC works

[1] Not Touched

[2] Touched

Consistent sensitivity of the touch pad is maintained by setting proper value of $\alpha$. 

$Z_{IN} < Z_{REF}$

$Z_{IN} > Z_{REF}$

Output Waveform
MB95870/860/860 Block Diagram

- **External Main Clock (32.5MHz)**
- **External Sub clock (32.768kHz)**
- **UART/SIO**
- **I2C**
- **Wild register 3ch**
- **Clock Supervisor Counter**
- **Watch dog timer**
- **On-chip debug**

**F2MC-8FX – CPU**

- Package: LQFP52,LQFP48,LQFP32, SOP24, TSSOP24
- \( t_{\text{cyclus}} \): 61.5 ns/32.5MHz(Etrn Clock)
- 62.5ns/16 MHz(Int CR)
- Supply Voltage: 2.4V - 5.5V
- Low voltage detector optional

- **MB95F876**
- **Flash**: 36K
- **SRAM**: 1024B

- **MB95F866**
- **Flash**: 36K
- **SRAM**: 1024B

- **MB95F856**
- **Flash**: 36K
- **SRAM**: 1024B

**Touch Sensor 12 channel**

- **Beep**
- **8/16 bit PPG timer 3ch**
- **Comparator 1 ch**
- **23bit Time base timer**
- **8/16 bit composite timer 2ch**
- **16bit Watch prescaler**
- **External interrupt 10ch**
- **ADC 10bit 8ch**
- **Low voltage detector**
- **On-chi Main CR Oscillator:** 4,8,10,12,16MHz
- **On-chi Sub CR Oscillator:** 100kHz

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Product Ideas

One chip solution

Max 12 Touch pts,
48/52pins MCU

Max 8 Touch pts,
32pins MCU

Max 5 Touch pts,
24pins MCU

MCU +TSC

32pins MCU + TSC*

20pins MCU + TSC*

16pins MCU + TSC*

*TSC touch point can be configured. Max: 12 touch points
TSC MCU Advantage
**Fujitsu TSC Advantage**

**Easy to use – 1 chip solution**

Use 1 chip can achieve “touch” and “Control” functions. Easy for engineer to design

**Price competitive -- Cost reduction for the customer**

Appliance is a price sensitive market.

**Operating supply voltage: 2.9V to 5.5 V**

To be compatible with other electronic device in Appliance and Industrial control

**Robust in EMC & EMI & ESD**

Touch Key performs reliability under all working conditions

**Package: Pin Pinch >=0.65 mm**

Easy to mount in appliance control board.
F²MC-8FX Family – High Quality & Reliability

- F²MC-8FX Family MB95870/860/850 Series is new family members of F²MC-8FX 8bit microcontrollers
- Enforcement of the existing F²MC-8FX family
  - 52pin, 48pin, 32pin, 24pin products
  - Up to 12 digital H/W TSC Channel
    - Fast, Robust, Low power, Easy for implement
- High quality & High reliability
  - Proven Flash technology made in Japan
  - 100K erase cycles, 20-year data retention
  - -40C to 85C operation range
- Safety & Security
  - Flash contents protection
  - Low voltage reset
  - Clock supervisor
- Easy
  - On-chip RC oscillator
  - Single-wire UART debug interface
  - Low cost development environment
- Support EEPROM emulation
Advantage of Fujitsu TSC MCU - One-Chip Solution

PCB Size down
※Compare with MCU+TSC ▲10%

▲15%-20%

Cost down
※BOM cost compared with MCU+TSC

Shorten development time

ESD: (With EVB)
IEC614000-4-2  8KV
EFT: (With EVB)
IEC614000-4-4  +4KV

Better EMC and water proof performance

Touchtune

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- **AIC™—Automatic Impedance Calibration**
  - The calibration interval is adjustable
  - Maintain consistent sensitivity despite environmental changes
    - temperature, humidity, production tolerance, etc.

![Diagram showing the concept of AIC™](image-url)
APIS™ — Adjacent Pattern Interference Suppression

There are three modes in APIS:

**APIS™ Mode 1**
Reports the strongest output only

**APIS™ Mode 2**
Reports all outputs that exceed predefined thresholds

**APIS™ Mode 3**
Reports two strongest outputs
Coupling Capacitance between two electrodes is measured
- Finger increases capacitance coupling
- Water drop has the same effect
- -> False touch detection

No ground or reference electrode
- Capacitance of pad is measured directly
- Water drop has nearly no effect
- -> No false trigger
Development tool
Platform Overview

- **Hardware**
  - EVB:
    - MB2146-540-EVB-V1.2.0
    - Or customer’s PCB
  - BGMA:MB2146-07-E
  - Power Supply: USB-B Cable
  - PC

- **Firmware**
  - Sample project:
    - (FWSC)TSCMCU-EVP

- **Software**
  - MCU Tool: Softune
  - Touch Tool: Touchune
  - Other program:
    - Driver of BGMA
    - Driver of Touchune: Microsoft .NET Framework

Relative Document:
MCU-AN-500146-E-01-TSCMCU-Setup_Development_Platform
Development tools - BGM Adaptor

PN: MB2146-07-E

- Small size
  - 58mm(W) x 90mm(L) x 25mm(H)
- USB2.0 interface to PC/SOFTUNE
- Single-wire UART interface to Commodity MCU
- RAM real time monitor
- Stand alone programming
- Power Supply for Target MCU
- Higher debug and programming performance
  - 10 times faster for programming
  - 5 times faster for debug

Please order the New BGMA in...
TSCMCU Demo Overview

- 12 channels TSC touch key
- 12 LEDs for touch status indication
- TSC directly controlled Beep
- 2 custom LEDs can be used to indicate system status
- UART communication interface
- External control jumper
- Support 2 power supply
  - 12V DC
  - USB 5V DC
- Clock (optional)
  - main clock
  - sub clock

Relative Document: MCU-UM-500014-E-03-MB2146_540_E-EVB_HW
Softune

- MCU code are debugged in Softune
- But for Touch:
  - debug in Touchtune
  - And then put related touch register parameters into user code
Touchtune

- Touchtune can help user
  - view touch running status
  - Fine tune suitable touch parameters
- Touchtune including
  - Control touch function
    - Read/write touch registers
    - “Warm Reset”
    - “Cold Reset”
  - Display touch sample value and graph
    - “Impedence”
    - “Cal_ impedance”
    - “Strength Value”
    - Control
  - Touch register parameter
    - “Save Config”
    - “Load Config”
- Tool
  - Timing chart
  - Touch area caculation
  - Manual Register control
  - Data Save and test dialog

Debug MCU and debug Touch all use the same toll MB2146-07-E BGMA Adapter
USB Programmer Operation

1. Open MB95F200 series USB programmer
2. Select MCU type (MB95F870/K)
3. Select Hex file by the path
4. Click Full Operation to start programming
5. The USB programmer also provides single operation, including Erase, Blank Check, Program, Read & Compare and Copy
Target applications
Target Applications - Home

- Larger Home Appliance
  - Washing machine
  - Air-conditioner
  - Refrigerator
  - Dishwasher
  - etc

- Small Home Appliance
  - Soy milk machine
  - Rice Cooker
  - Bread machine
  - Water heater
  - IH cooker Display
  - Water purify machine
  - Electronic tooth brush
  - Bladeless fan
  - Etc
Target Application - Industrial

Application examples

---- wherever robust human input device is needed

- Control panels
- Medical instrument
- Test & Measurement Equipment
- Special vehicle
Target Application – Portable Device
Target Application – Office equipment

And Many More…
Support material
General Application Note

- MCU-AN-500135-E-01-TSCMCU-HW_Guideline
- MCU-AN-500136-E-01-TSCMCU-FW_Guideline
- MCU-AN-500137-E-01-TSCMCU-IMPEDANCE_VS_Enviroment
- MCU-AN-500139-E-01-TSCMCU-Sensitivity_VS_Cover
- MCU-AN-500140-E-01-TSCMCU-Migration_to_TSCMCU
- MCU-AN-500141-E-01-TSCMCU-Waterproof_Guideline
- MCU-AN-500142-E-01-TSCMCU-Quick_Taste_Register
- MCU-AN-500143-E-01-TSCMCU-Test_Method
- MCU-AN-500144-E-01-TSCMCU-Trouble_Shooting
- MCU-AN-500146-E-01-TSCMCU-Setup_Development_Platform
- MCU-AN-500147-E-01-TSCMCU-Get_First_Touch_Project
- MCU-AN-500155-E-01-TSCMCU-Design_Guide.docx
- MCU-AN-500156-E-01-TSCMCU-Start_Guide
More Information—Touchtune AN

- Touchtune AN
  - MCU-AN-500145-E-01-TSCMCU-Quick_Start_with_Touchtune
  - MCU-AN-500148-E-01-TSCMCU-Tuning_Parameters_by_Touchtune
  - MCU-AN-500149-E-01-TSCMCU-Tuning_Sensitivity_by_Touchtune
  - MCU-AN-500150-E-01-TSCMCU-Tuning_for_Cover_by_Touchtune
  - MCU-AN-500151-E-01-TSCMCU-Tuning_for_Water_Robust_by_Touchtune
  - MCU-AN-500152-E-01-TSCMCU-Observe_Noise_by_Touchtune
  - MCU-AN-500153-E-01-TSCMCU-Check_Touch_by_Touchtune
  - MCU-AN-500154-E-01-TSCMCU-Solve_Special_Problem_by_Touchtune

- Flyers
- Website: http://www.fujitsu.com/cn/fss/mcu/
## ORDERING INFORMATION

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