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 8bit MCU Line Up

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<tr>
<th>CY 2011</th>
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<td>32pin MB95F434 IH Comparator</td>
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<td>MB95F818</td>
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<td>80pin MB95F318 LCDC</td>
<td>MB95F418 8com LCDC</td>
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## Full Line UP

- **MB95F876/866/856 Touch MCU**
- **New**
TSC MCU Overview
2 in 1 TSC MCU – A Revolution

MB95870 series

Evolution

MCU

TSC Chip

For main control

For touch interface

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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
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 $\alpha$. 
MB95870/860/850 Block Diagram

External Main Clock (32.5MHz)

External Sub clock (32.768kHz)

F²MC-8FX – CPU
\[ t_{cyclus} = 61.5 \text{ ns} / 32.5 \text{MHz} (\text{Ext Clock}) \]
\[ 62.5 \text{ns} / 16 \text{MHz} (\text{Int CR}) \]
Supply Voltage: 2.4V - 5.5V
Low voltage detector optional

UART/SIO

I2C

Wild register 3ch

Clock Supervisor Counter

Watch dog timer

On-chip debug

Package: LQFP52, LQFP48, LQFP32
SOP24, TSSOP24

Touch Sensor 12channel

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

MB95F876
Flash 36K
SRAM 1024B

MB95F866
Flash 36K
SRAM 1024B

MB95F856
Flash 36K
SRAM 1024B

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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: 2.4V 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.

Initial setup sensitivity

Sensitivity changes with environment changes

Sensitivity stays consistent
APISTM

APISTM——Adjacent Pattern Interference Suppression

There are three modes in APISTM:

**APISTM Mode 1**
Reports the strongest output only

**APISTM Mode 2**
Reports all outputs that exceed predefined thresholds

**APISTM Mode 3**
Reports two strongest outputs
Water proof

- 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-EVB

- **Software**
  - MCU Tool: Softune
  - Touch Tool: Touchtune
  - Other program:
    - Driver of BGMA
    - Driver of Touchtune: 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

Available Now
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
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_impedence”
    - “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

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Programmer

- 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

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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_Environment
- 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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<tr>
<td>MB95F856KPFT-G-SNE2</td>
<td>24-pin plastic TSSOP (FPT-24P-M10)</td>
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<td>MB95F856KPF-G-SNE2</td>
<td>24-pin plastic SOP (FPT-24P-M34)</td>
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<td>MB95F866KPMC-G-SNE2</td>
<td>32-pin plastic LQFP (FPT-32P-M30)</td>
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<td>48-pin plastic LQFP (FPT-48P-M49)</td>
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<td>52-pin plastic LQFP (FPT-52P-M02)</td>
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