



**THE DATASHEET OF
MB2146-510-01-E**





MB95560H/570H/580H Series

8-bit Microcontroller

8FX Family Starter Kit MB2146-510-01-E Setup Guide

Doc. # 002-05587 Rev. *A

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Preface



Thank you for purchasing the New 8FX Family Starter Kit: MB2146-510-01-E*¹.

This product is a starter kit for New 8FX MB95560H/570H/580H series, which comes with MB2146-07-E (New 8FX Family All Series MCU BGM Adaptor)*², MB2146-510-E (New 8FX Family MB95560H/570H/580H Series Evaluation Board)*³, and F²MC8L/8FX Family SOFTUNE Professional Pack Evaluation Version*⁴.

This manual explains how to use the Starter Kit. Be sure to read this manual before using the product.

For mass production/evaluation MCUs for this product, consult with sales representatives or support representatives.

*¹Referred below as the "Starter Kit".

*²Referred below as the "BGMA".

*³Referred below as the "EV-Board".

*⁴Referred below as the "SOFTUNE".

SOFTUNE is a trademark of Cypress Semiconductor Limited, Japan.

■Handling and use

Handling and use of this product and notes regarding its safe use are described in the manuals for products bundled with the Starter Kit.

Follow the instructions in the manuals to use this product.

Keep this manual at hand so that you can refer to it anytime during use of this product.

■European RoHS compliance

Products with a -E suffix on the part number are European RoHS compliant products.


■Notice on this document


All information included in this document is current as of the date it is issued. Such information is subject to change without any prior notice.

Please confirm the latest relevant information with the sales representatives.

■ **Caution of the products described in this document**

The following precautions apply to the product described in this manual.

 WARNING	<p>Indicates a potentially hazardous situation which could result in death or serious injury and/or a fault in the user's system if the product is not used correctly.</p>
Electric shock, Damage	<p>Before performing any operation described in this manual, turn off all the power supplies to the system. Performing such an operation with the power on may cause an electric shock or device fault.</p>
Electric shock, Damage	<p>Once the product has been turned on, do not touch any metal part of it. Doing so may cause an electric shock or device fault.</p>

 CAUTION	<p>Indicates the presence of a hazard that may cause a minor or moderate injury, damages to this product or devices connected to it, or may cause to loose software resources and other properties such as data, if the device is not used appropriately.</p>
Cuts, Damage	<p>Before moving the product, be sure to turn off all the power supplies and unplug the cables. Watch your step when carrying the product. Do not use the product in an unstable location such as a place exposed to strong vibration or a sloping surface. Doing so may cause the product to fall, resulting in an injury or fault.</p>
Cuts	<p>The product contains sharp edges that are left unavoidably exposed, such as jumper plugs. Handle the product with due care not to get injured with such pointed parts.</p>
Damage	<p>Do not place anything on the product or expose the product to physical shocks. Do not carry the product after the power has been turned on. Doing so may cause a malfunction due to overloading or shock.</p>
Damage	<p>Since the product contains many electronic components, keep it away from direct sunlight, high temperature, and high humidity to prevent condensation. Do not use or store the product where it is exposed to much dust or a strong magnetic or electric field for an extended period of time. Inappropriate operating or storage environments may cause a fault.</p>
Damage	<p>Use the product within the ranges given in the specifications. Operation over the specified ranges may cause a fault.</p>
Damage	<p>To prevent electrostatic breakdown, do not let your finger or other object come into contact with the metal parts of any of the connectors. Before handling the product, touch a metal object (such as a door knob) to discharge any static electricity from your body.</p>

<p>Damage</p>	<p>When turning the power on or off, follow the relevant procedure as described in this document. Before turning the power on, in particular, be sure to finish making all the required connections. Furthermore, be sure to configure and use the product by following the instructions given in this document. Using the product incorrectly or inappropriately may cause a fault.</p>
<p>Damage</p>	<p>Always turn the power off before connecting or disconnecting any cables from the product. When unplugging a cable, unplug the cable by holding the connector part without pulling on the cable itself. Pulling the cable itself or bending it may expose or disconnect the cable core, resulting in a fault.</p>
<p>Damage</p>	<p>Because the structure of the MCU socket does not allow an evaluation MCU to be mounted in the incorrect orientation, be very careful of the orientation of the evaluation MCU when mounting it. Inserting the evaluation MCU in the wrong orientation may damage the MCU, causing the MCU to become faulty.</p>
<p>Damage</p>	<p>Because the product has no casing, it is recommended that it be stored in the original packaging. Transporting the product may cause a damage or fault. Therefore, keep the packaging materials and use them when re-shipping the product.</p>

1. Product Overview



This product is a set of Starter Kit of MB95560H/570H/580H series. It is composed of a BGMA and an EV-board. Combining the SOFTUNE Workbench on PC, the Starter kit enables the quick start of development before the user system is ready.

1.1 Objective and Deliverable

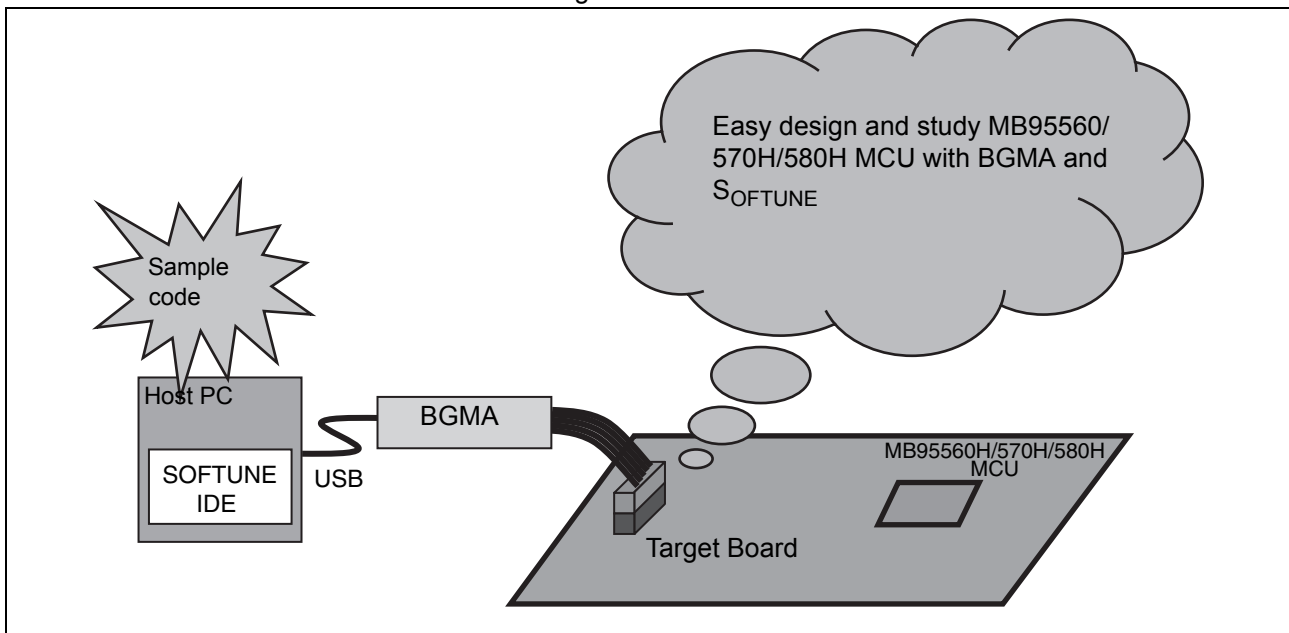
The Starter kit provides users a complete development platform. Before start using the Starter Kit, make sure that the following devices are placed in the package:

- BGMA : 1
- EV-board : 1
- USB cable: 1
- CD-ROM (SOFTUNE user manuals, sample code): 1
- Hardcopy (China RoHS report, quick start guide) : 1

1.2 System Block

To setup a debugging system, connect a PC, a BGMA and an EV-board together as shown below:

Figure 1-1. BGMA overview



1.3 Handling Precautions

The Starter Kit can be used in connection with its bundled products. To ensure correct use of this product in a proper environment, observe the following guideline:

Follow the instructions described in each manual for the bundled product to use this product.

1.4 Feature

The MB95560H/570H/580H Series starter kit is the best for a performance and functional evaluation, and a check of operation before including MB95560H/570H/580H Series in a user's system.

Below, the feature of the BGM debugger for MB95560H/570H/580H Series is shown.

- Microcomputer operation voltage. It corresponds to +2.4V to +5.5V.
(The maximum and minimum of microcomputer operation voltage and frequency of operation differs with each MCU. refer to the documents (a data sheet, hardware manual, etc.) of each device relation for the operation voltage and frequency of MCU of operation.)
- Compact development environment, a light and small BGM Adaptor.
- Since a monitor program is performed in exclusive memory space, it does not consume user memory space.
- Continuation execution, step execution and break correspondence.
- It connects with a host computer by the USB interface.

1.5 Hardware Setup

In the hardware setup procedure, you configure and connect the hardware products. This chapter includes the configuring and connecting procedure for each product in order. Check the contents and complete the hardware setup.

- Configuring EV-Board
- Connection of each product
 - Connecting BGMA and EV-board
 - Connecting EV-Board power supply

2 BGMA Manual

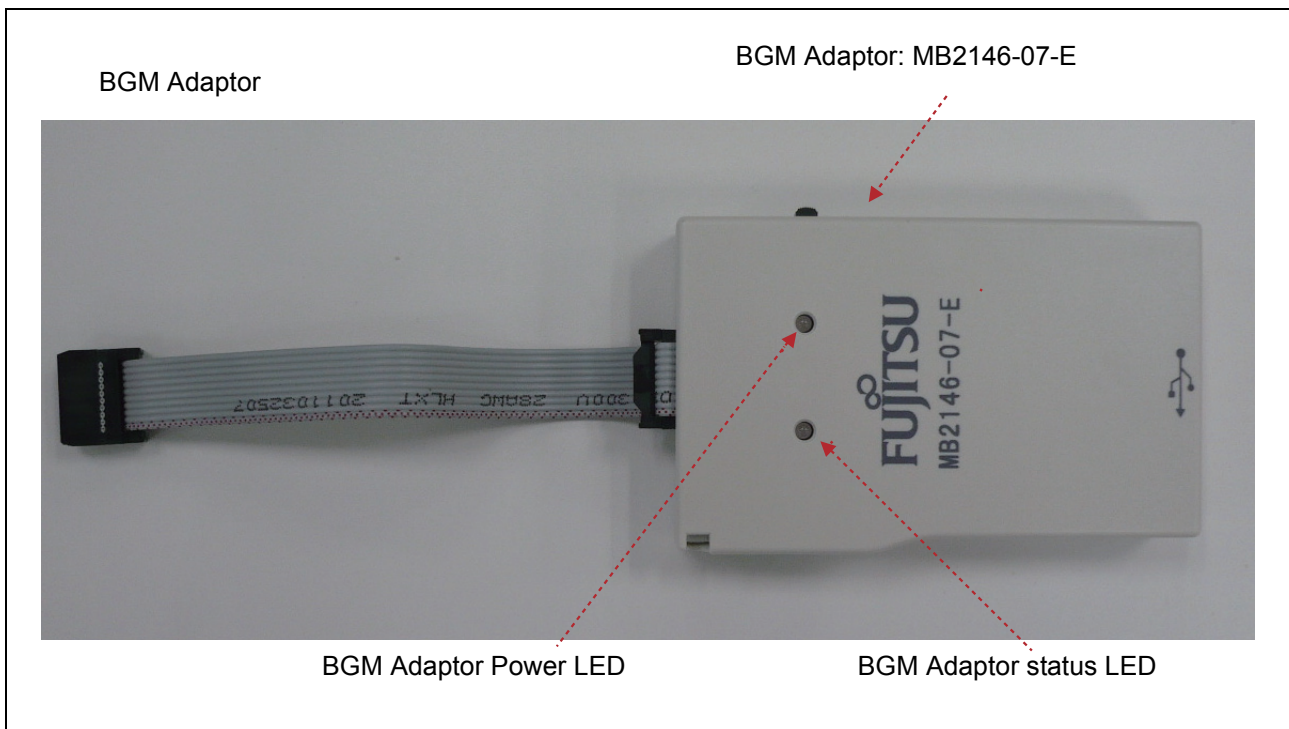


2.1 BGMA Overview

Below is the close look of the BGMA.

It provides a debug platform for the New 8FX MCU (except MB95200H/210H/220H) in a small size (58mm (W) × 90mm (D) × 20mm (H)) .

Figure 2-1. BGMA overview



2.2 Function List

Function description	Remarks
Support MB95560 Series MCU	MCU MAX machine clock: 16.25 MHz MCU power voltage: 2.4V* ² to 5.5V* ¹
Break pointer	256 software breakpoints 3 hardware breakpoints
USB interface to PC/SOFTUNE	Compatible to USB protocol version 2.0
1-Line UART interface to the MB95560 Series MCU	The Baud rate is 62,500 bps, and can be up to 500kbps (set in S _{OFTUNE})
Support the MCU flash programming for engineering development	The MAX program and read speed can be arrived to 4000B/s 5000B/s roughly.

*1The value varies depending on the operating frequency, the machine clock or the analog guaranteed range.

*2The value is 2.88 V when the low-voltage detection reset is used.

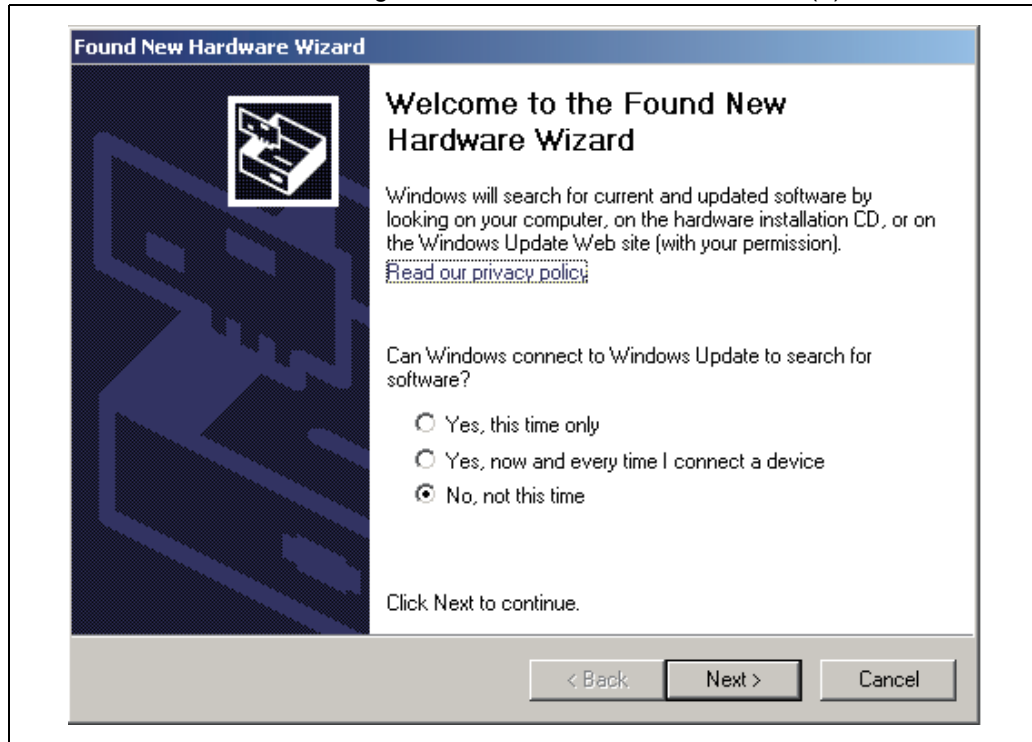
2.3 IDC10 Interface Description

Pin Number	Pin Name	Description
1	UVCC	Target MCU Vcc
2	GND	Target MCU Vss
3	RSTIN	Target MCU reset input
4	RSTOUT	Target MCU reset output
5	RSV	Reserved
6	POUT3V	Supply 3V power out, when this function enabled
7	RSV	Reserved
8	DBG	Target MCU debug pin
9	RSV	Reserved
10	RSV	Reserved

2.4 BGM Adapter USB Configuration

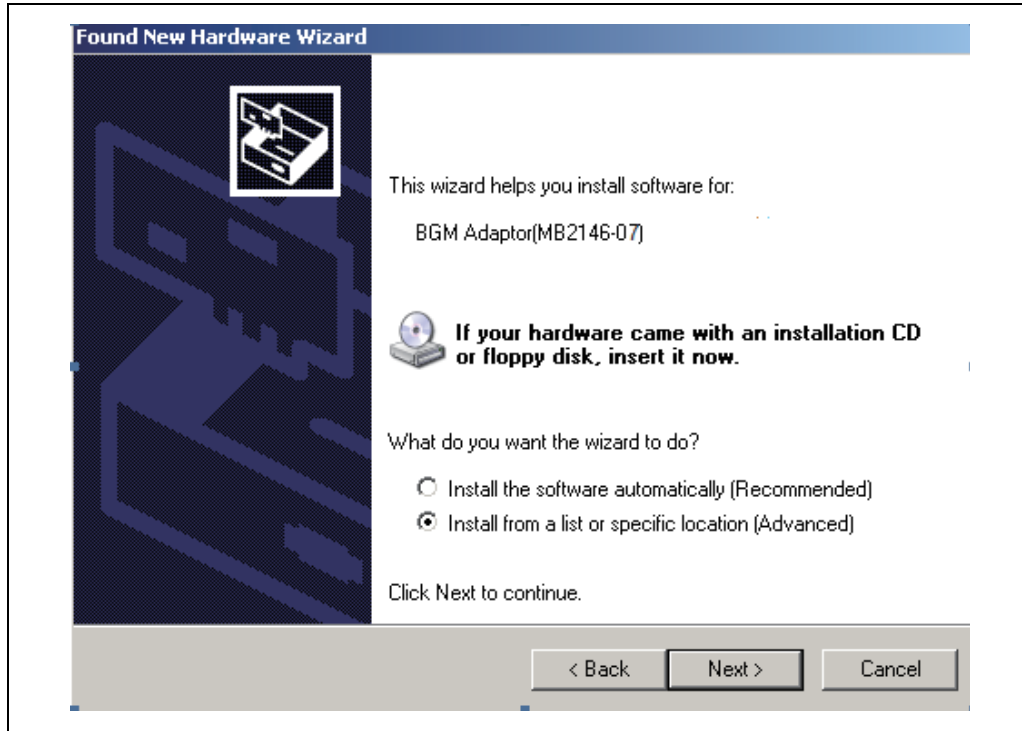
The BGMA is provided with a USB cable. Connect the BGMA to a PC with a USB cable. If the connection is right, the following window will pop up. Follow the instructions displayed, and then click **“Next”**,

Figure 2-2. Install BGMA in Windows (1)



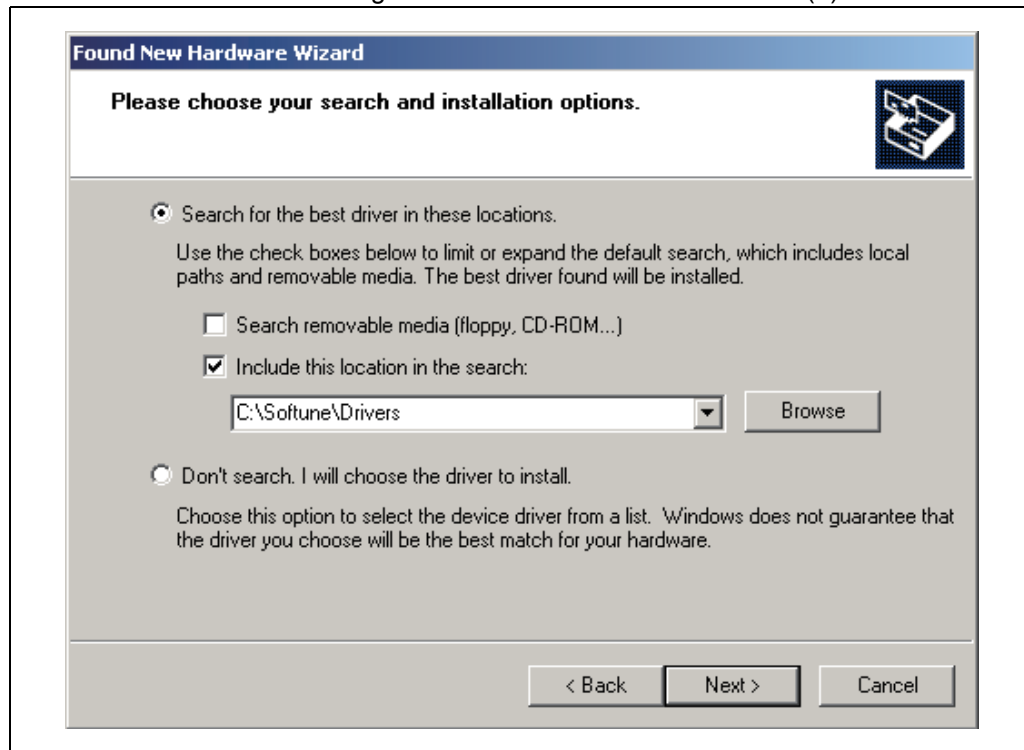
Select **“Install from a list or specific location (Advanced)”**, then click **“Next”**,

Figure 2-3. Install BGMA in Windows (2)

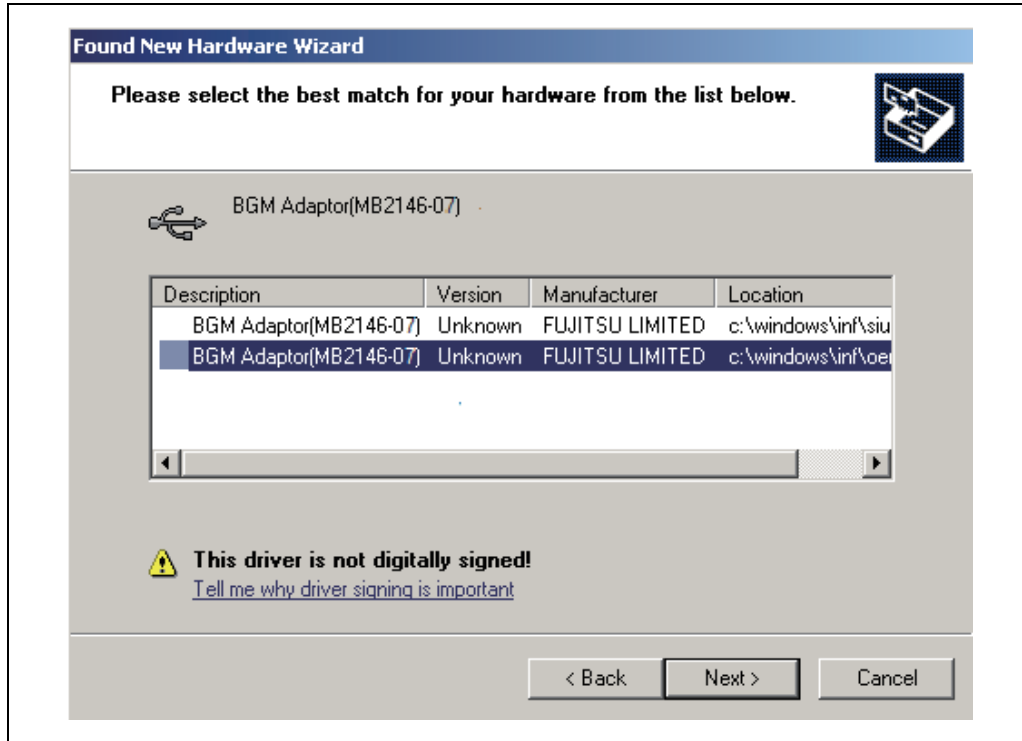


Select **“...\Drivers”** from the folder where SOFTUNE is installed, click **“Next”**,

Figure 2-4. Install BGMA in Windows (3)



Select BGMA (MB2146-07) as displayed below, and then click “Next”,
 Figure 2-5. Install BGMA in Windows (4)



Windows will install the driver automatically. Click “Finish” after the driver has completed the installation normally. Then users can find the BGMA is recognized as MB2146-07 in Windows system.

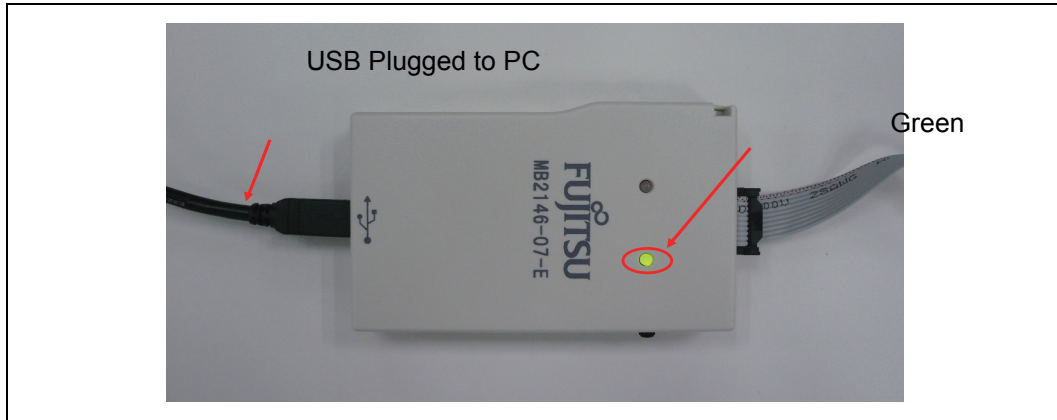
Figure 2-6. BGMA is installed in Windows



2.5 LED description

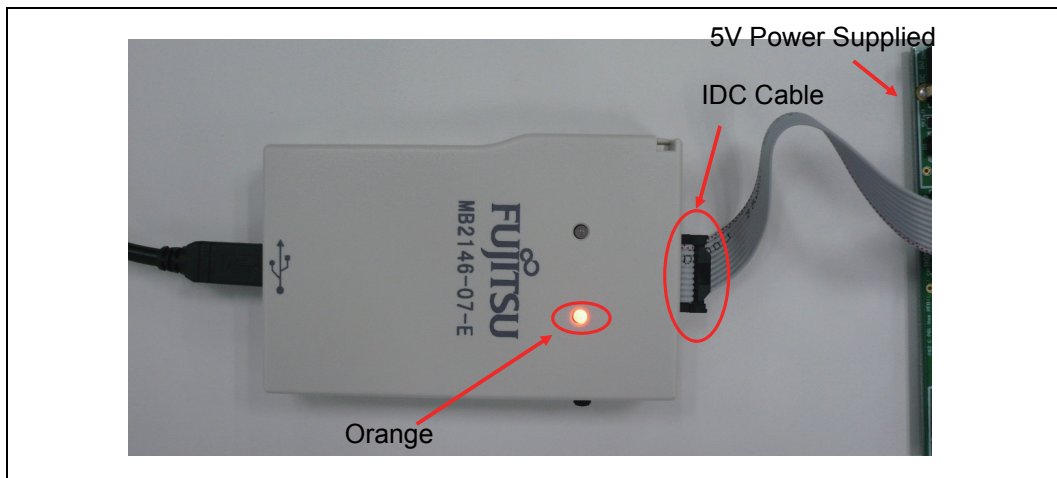
First, only plug USB cable to PC, checking the Power LED on BGMA turns Green.

Figure 2-7. BGMA Power LED (1)



Second, plug IDC10 cable to the EV-board (target MCU board), then turn on EV-board. After that check Power LED on the BGMA turns Orange.

Figure 2-8. BGMA Power LED (2)



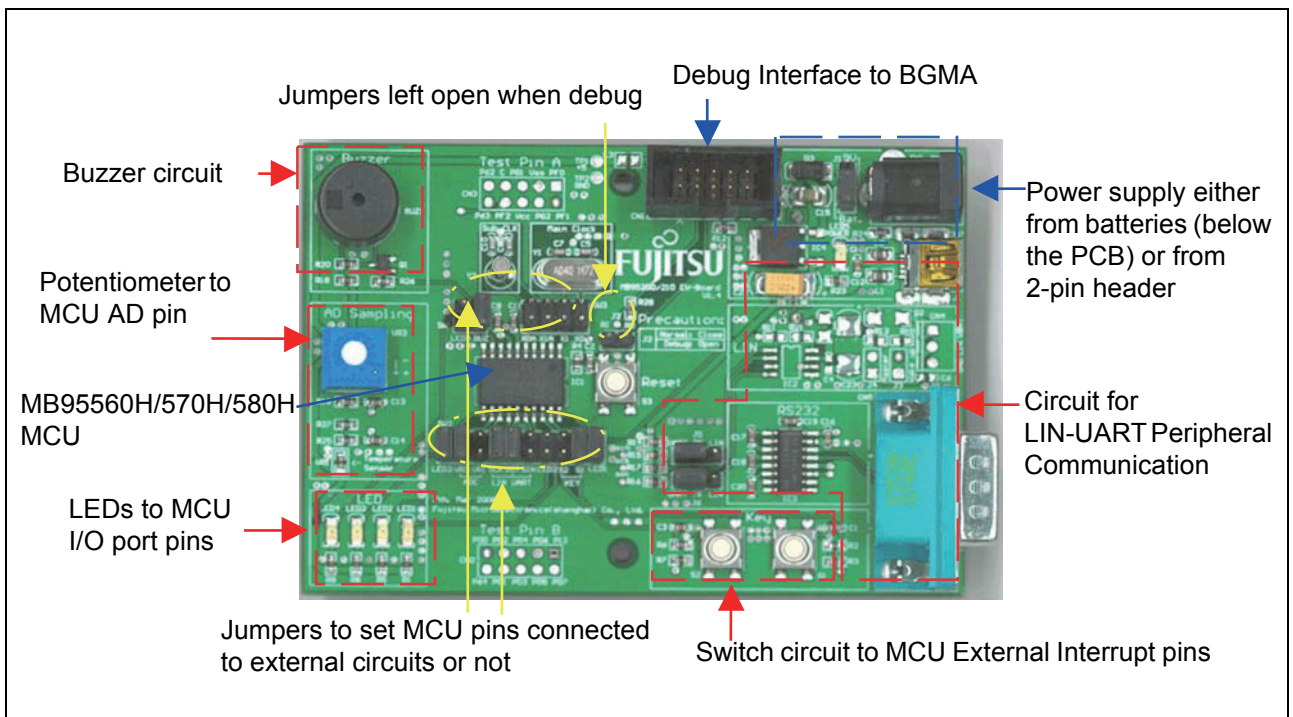
3. EV board Introduction



3.1 EV board Overview

MB95560 MCU EV-board is provided as a user-friendly introductory and evaluation platform for the MB95560H/570H/580H MCU Family microcontrollers. Below is a close look of EV-board.

Figure 3-1. EV-board Overview



3.2 Function List

The EV-board consists of a board and a sample firmware. The board provides a useful platform for using the MCU and its peripherals. It is a useful development platform together with a BGMA and a S_{OFTUNE}. It features the following functions,

- Clock and sub-clock
- USB 5V power IF, external 5V power IF and the battery
- Reset circuit and reset key
- Provide IDC10 debug interface
- LEDs for general use, LED1 indicates DBG pin work status
- Provide one buzzer to demonstrate timer output
- 2 keys for general use
- Potentiometer and temperature sensor
- RS-232 level converter and DB9 interface (MAX232)
- LIN circuit reserved
- SIO 4 pins reserved
- All MCU ports are easy accessible through test pins
- Optional Starter kit to support each available MCU packages

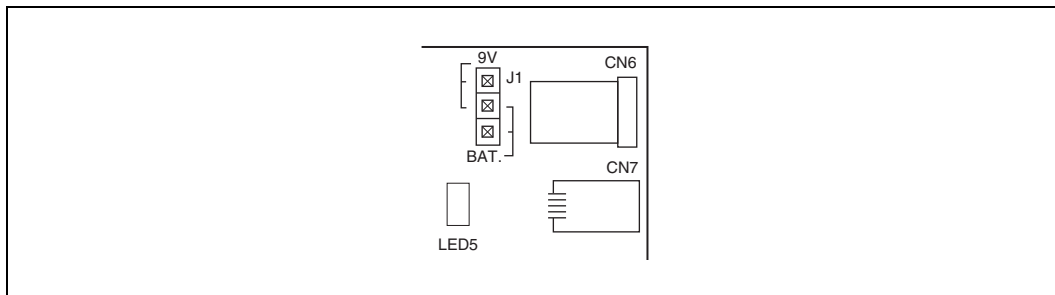
3.4 HW Module Description and Jumper settings

3.4.1 Power Module

EV-board has 4 kinds of power supply for user to choose. Please read below instructions before using.

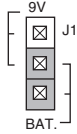
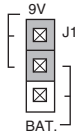
- DC Adaptor: 9V DC:
Output voltage: 9V
Connection: Connector (CN6)
- Battery:
QTY: 4PCS;
Model: AA;
Nominal voltage: 1.5V.
Connection: Socket for Battery
- External Power Supply:
There are 2 test points (TP1&2) on EV-board which can supply power to target board (EV-board).
Power on method: short L3 on EV-board; then connect anode of DC power to TP1 (MCU Vcc) and cathode to TP2 (MCU GND).
- USB cable:
The Mini-B USB receptacle is only for supplying power to EV board by PC USB port. The current and power of this method is limited in 100mA/0.5W.
Please make sure to supply stable power via the Mini-B USB receptacle while operation.
If any of the power supplies is connected to the EV-board correctly, power LED (LED5) on the EV-board will be on.

Figure 3-3. Power Module



The following two power supplies are recommended. Please follow the settings below,

Table 3-1. Power Supply Selection

Power supply	Header name	Settings
4 AA batteries from BT1 on the back of the EV-board.	J1: BAT.	
9V DC from CN6	J1: 9V.	

BGMA Interface

To start the debug using a BGMA, users shall connect IDC10 socket from the BGMA to CN1 on an EV-board, and J2 shall be closed to enable reset key S3.

Figure 3-4. Debug Interface.

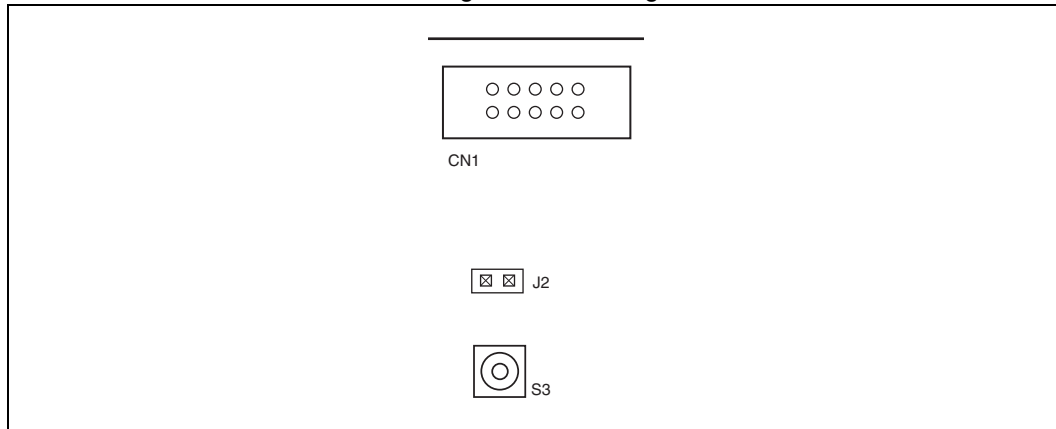



Table 3-2. J2 Setting

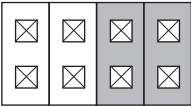
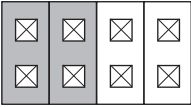
MCU Mode	Header name	Settings
Debug, normal mode	J2	 J2

This setting is effective just when BGMA (MB2146-07-E) is connecting to STK board (MB2146-510-E). The other BGMA circuit is different from MB2146-07-E. When STK board connects to other BGMA that may broke the MCU of STK board, so please use the products in this package. For the package information please refer to “1.1 Objective and Deliverable”.

Clock Settings

The MB95560H/570H/580H series MCU uses an internal main CR as a clock source by default. Users can select on-board crystal as a main clock and a sub-clock. Follow the settings below:

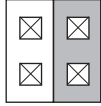
Table 3-3. SW3 Setting

Clock	Header name	Settings
Main clock	SW3: X1, X0	 SW3
Sub-clock	SW3: X1A, X0A	 SW3

Buzzer Module

A buzzer module is provided to demonstrate an 8/16 composite timer output (a continuous mode). To enable buzzer module, follow the table below:

Table 3-4. SW1 Setting

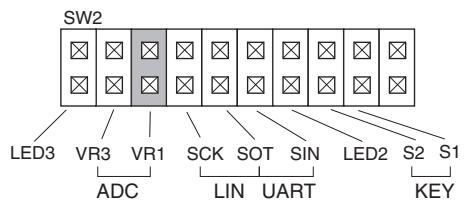
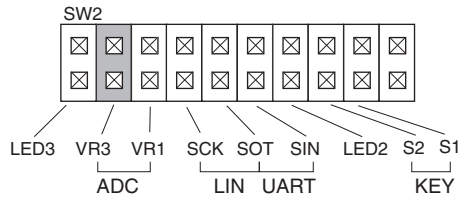
Modules	Header name	Settings
Buzzer: BUZ1	SW1: BUZ.	 SW1 LED4 BUZ

A/D Module

VR1 and VR3 are to demonstrate a MCU A/D converter usage. Select VR1 or VR3 by the following table.

VR1 is connected to MCU A/D channel 1, and VR3 is connected to MCU A/D channel 0.

Table 3-5. SW2 A/D Setting

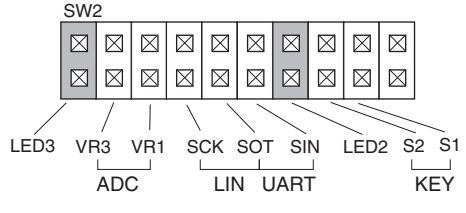
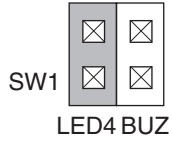
MCU Mode	Header name	Settings
A/D: VR1	SW2: VR1	
A/D: VR3	SW2: VR3	

LED Module

There are four LEDs on EV-board to demonstrate the I/O function.

Enable LED2, LED3 and LED4 in the following table,

Table 3-6. SW2 LED Setting

Modules	Header name	Settings
LED*: LED2, LED3, LED4	SW2: LED2, LED3	
	SW1: LED4	

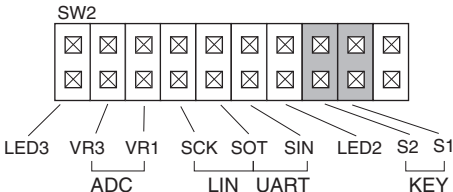
*LED module has four LEDs in total, but P12 (LED1) is not active in a debug mode using BGMA.

Key Module

Key S1 and key S2 are provided to demonstrate an external interrupt function. Enable these two keys by the following table.

Key S1 is connected to external Int7, and key S2 is connected to external Int6.

Table 3-7. SW2 Key Setting

Modules	Header name	Settings
Key: S1, S2	SW2: S1, S2	

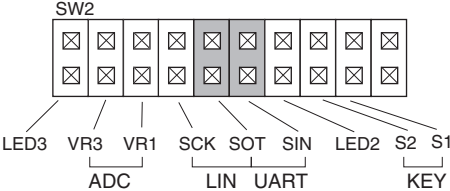
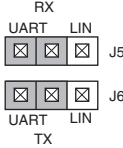
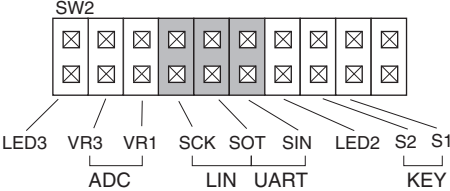
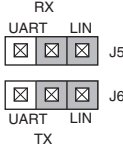
Lin-UART Module

Lin-UART module can be configured as a LIN or an UART module. Enable each module by the following table.

The UART module features an RS232 transceiver and a standard DB9 interface with PC.

Lin module enables an easy setup of Master/Slave communication by a Lin bus.

Table 3-8. UART Setting

Modules	Header name	Settings
UART	SW2: SOT, SIN	
	J5: UART J6: UART	
LIN*	SW2: SCK, SOT, SIN	
	J5: LIN J6: LIN	

*LIN module is optional; contact your local distributor for the EV-board with a LIN module.

4. Sample Code Manual



4.1 Topic List

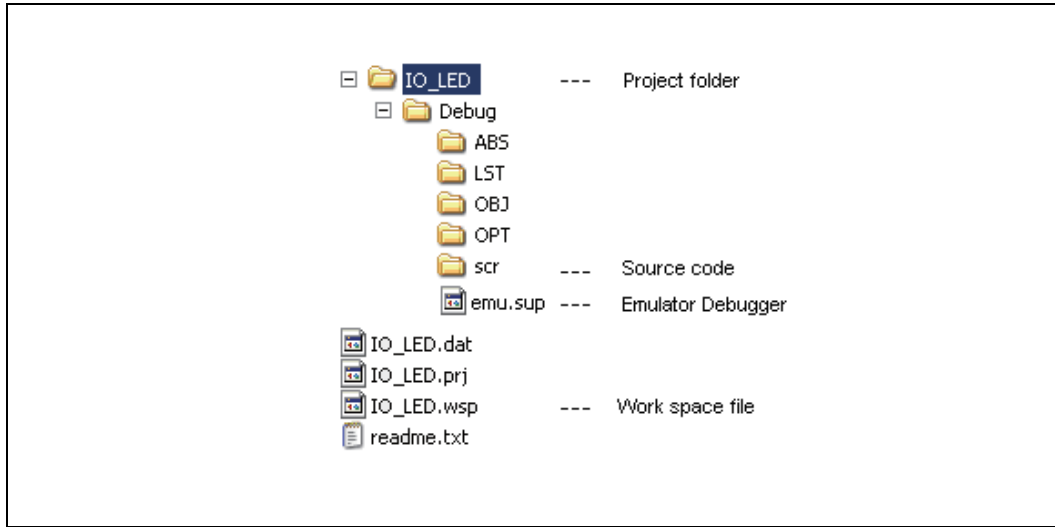
The following sample codes are provided with MB95560H/570H/580H MCU Starter Kit,

- IO_LED project
In this example, the LED2 will be twinkle.
- A/D_Potentiometer project
In this example, the 3 LEDs will display “on” or “off” according to the arrow direction of VR3.
- Timer_Buzzer project (Continuous timer)
In this example, Buzzer will be on once by pressing Key S1; Buzzer will be on twice by pressing Key S2.
- ExInt_Key Project
Press Key S1, the 3 LEDs will be on in the following sequence:
...->LED4->LED3->LED2...
Press Key S2, the 3 LEDs will be on in the following sequence:
...->LED2->LED3->LED4...
- UART project
In this example, the MCU works in an asynchronous mode.
(9,600bps, 1 stop bit, no parity)
After a reset, the MCU will send "Welcome to the LIN-UART (asynchronous mode) of MB95560series (8FX)" to RS232 transceiver.
Then the MCU feedbacks any bytes it received.
- SIO project
This example uses two EV-boards to demonstrate the SIO (synchronous mode) function.
(9600bps)
One MCU keeps sending data while the other keeps receiving. One LED is toggled to indicate the communication is correct.
- LIN slave
In this example, the MCU is running in a Lin Slave mode. After a reset, the MCU is waiting for data from the Master. If the data is received correct, LED4 starts twinkling.
- LIN master
In this example, the MCU is running in a Lin Master mode. After a reset, the MCU starts sending data to a Slave. If the Master gets correct data from the Slave, the MCU restarts sending. While sending data to the Slave, LED2 keeps twinkling.

4.2 Project Structure

The Sample code is organized by the following structure in each project. Here take IO_LED project for example shown in [Figure 4-1](#).

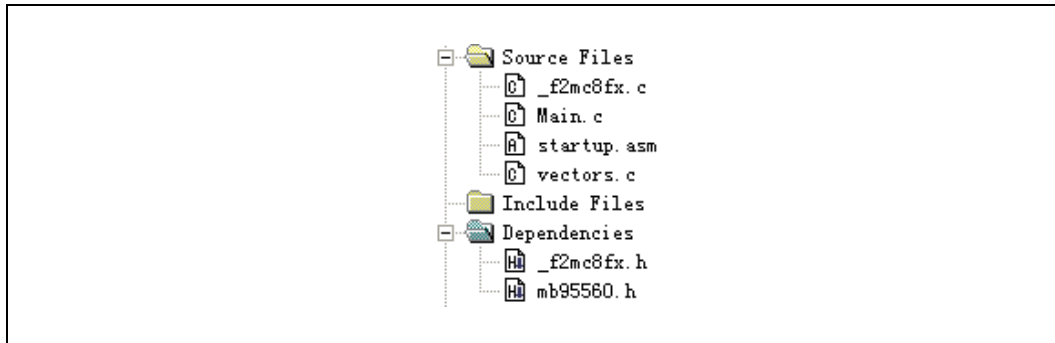
Figure 4-1. I/O_LED Project Structure



4.3 Source Code File Description

Six files are available in each sample code source code folder shown below,

Figure 4-2. Source Code Files



4.3.1 Header Files

The MB95560.h and the _f2mc8fx.h are header files, included MB95560H/570H/580H MCU I/O registers definition;

Here take PDR0 for example. In MB95560.h, PDR0 is defined as below.

```

/* REGISTER BIT STRUCTURES */
#ifdef __IO_DEFINE
#pragma segment IO=IO_PDR0, locate=0x0
#endif

typedef union {

```

```

__BYTEbyte;
    struct {
        __BYTE    P00:1;
        __BYTE    P01:1;
        __BYTE    P02:1;
        __BYTE    P03:1;
        __BYTE    P04:1;
        __BYTE    P05:1;
        __BYTE    P06:1;
        __BYTE    P07:1;
    } bit;
    struct {
        __BYTE    P00:1;
        __BYTE    P01:1;
        __BYTE    P02:1;
        __BYTE    P03:1;
        __BYTE    P04:1;
        __BYTE    P05:1;
        __BYTE    P06:1;
        __BYTE    P07:1;
    } bitc;
} PDR0STR;

__IO_EXTERN        PDR0STR    IO_PDR0;
#define    _pdr0        (IO_PDR0)
#define    PDR0        (IO_PDR0.byte)
#define    PDR0_P00    (IO_PDR0.bit.P00)
#define    PDR0_P01    (IO_PDR0.bit.P01)
#define    PDR0_P02    (IO_PDR0.bit.P02)
#define    PDR0_P03    (IO_PDR0.bit.P03)
#define    PDR0_P04    (IO_PDR0.bit.P04)
#define    PDR0_P05    (IO_PDR0.bit.P05)
#define    PDR0_P06    (IO_PDR0.bit.P06)
#define    PDR0_P07    (IO_PDR0.bit.P07)

```

4.3.2 Startup.asm File

The Startup.asm is the MB95560H/570H/580H MCU initialization file including stack settings, register bank settings and watchdog settings etc;

4.3.3 Vectors.c File.

The Vectors.c contains the MB95560H/570H/580H MCU Interrupt vectors definition.

User can pre-set all interrupt control registers in function InitIrqLevels(). It can be used to set all interrupt priorities in static applications. For example, to set the external interrupt ch.0 to level 0, change the following code:

```
ILR0 = 0xFF;    // IRQ0: external interrupt ch.0 | ch.4
                // IRQ1: external interrupt ch.1 | ch.5
                // IRQ2: external interrupt ch.2 | ch.6
                // IRQ3: external interrupt ch.3 | ch.7
```

To

```
ILR0 = 0xFC;    // IRQ0: external interrupt ch.0 | ch.4
                // IRQ1: external interrupt ch.1 | ch.5
                // IRQ2: external interrupt ch.2 | ch.6
                // IRQ3: external interrupt ch.3 | ch.7
```

And declare the interrupt function as in Vectors.c below,

```
... ..
__interrupt void external_int00 (void);
... ..
#pragma intvect external_int00 0 // IRQ0: external interrupt ch.0 | ch.4
```

Then user can write his own interrupt sub-routine in Main.C shown as below.

```
/*----- INTERRUPT SERVICE ROUTINE -----*/
-----*/
__interrupt void external_int00 (void)
{
    //User code
}
```

4.3.4 Main.c File

Main.c contains the user code.

5. Development Platform Quick Start



5.1 Tools Setup Sequence

Start the debugging system in the following sequence:

- Connect a BGMA to the PC using a USB cable, confirm the LED on the BGMA is Green;
- Connect an EV-board to BGMA IDC10 socket;
- Select the EV-board power supply and turn on the EV-board, confirm the power LED on the BGMA is Orange and the Power LED on the EV-board is on.

5.2 Open Project and Start Debug

Users can start a debug from a PC software SOFTUNE workbench in the following sequence. Here take IO_LED project for example.

- Start the SOFTUNE from "Startup Menu>Programs> SOFTUNE V3> FFMC-8L Family SOFTUNE Workbench" in Windows;
- Click "Open workspace" from "File" Menu in SOFTUNE;
- Select "IO_LED.wsp" in "Open Space" window;
- Click "Start debug" from "Debug" Menu.

If the entire procedure goes right, a debug will start normally.

5.3 Operation Precautions

- All pins of MB95560H/570H/580H MCU are connected to Testing Pin on the EV-board. If the user wants to test separate pin performance, do disconnect the header of related peripheral modules.
- For the power of STK EV-board, do not use the different power supply (single-3 battery or 9V DC) at the same time
- Since the device and BGMA may be broken, please use the bundled BGMA with STK EV-board.

6. Additional Informations



For more informations please visit our websites:

<http://www.cypress.com/documentation/development-kitsboards/mb2146-510-01-e>

Please contact your local support team for any technical question.

Revision History





Document Revision History

Document Title: MB95560H/570H/580H Series 8-bit Microcontroller 8FX Family Starter Kit MB2146-510-01-E Setup Guide				
Document Number: 002-05587				
Revision	ECN#	Issue Date	Origin of Change	Description of Change
**	—	11/24/2011	HUAL	Initial release
*A	5309214	05/16/2016	HUAL	Migrated to Cypress format

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