32-BIT MICROCONTROLLER

MB9AA30N SERIES

BLUEMOON-EVB FIRMWARE

USER MANUAL

FUJITSU

Revision History

Version	Date	Updated by	Approved by	Modifications
1.0.0	2012-10-29	Abel Ma		First Draft
1.1.0	2012-11-27	Abel Ma		Modify some content in chapter 5

This manual contains 31 pages.

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1 Introduction

1.1 Purpose

This user manual describes FUJITSU Bluemoon EV Board, and the firmware configuration.

The firmware main includes TSC, RTC, LCD, ADC, LPCM, LVD, Key driver and so on functions.

1.2 Document Overview

The rest of document is organized as the following:

Chapter 2 explains *System Hardware Environment*.

Chapter 3 explains *Development Environment*.

Chapter 4 explains *System Function*.

Chapter 5 explains *Event Function*.

Chapter 6 explains *Driver Function*.

Chapter 7 explains *Interrupt Function*.

Chapter 8 explains *Demo System*.

2 System Hardware Environment

Hardware Environment

- CPU Chip: Fujitsu MB9AA30N;
- CPU Frequency: 20MHz;
- Minimum Instruction Time: 50ns;
- Ram Space: 1KBytes;
- Code Space: 14KBytes;

3 Development Environment

Development Environment

Table 3-1: MCU Development Environment

Name	Description	Part Number	Manufacture	Remark
IAR bedded Workbench	FW development and debug			
JLink	Debug and Load FW			

4 System Function

Note: More information about RTC, refer to FUJITSU MCU-AN-510045-E-10.pdf.

4.1 Macro Define

Name	Description	Value	Mark
POWER_SUPPLY_TIME	The time of watching power changed cycle	200	ms
DisplayKeyModeTime	How long about display current time	5000	ms
TSCKEY_OffsetL3	Adjust TSC key sensitivity	40	N/A
LedIndicateTime	The time about LED to indicated if touch key	500	ms
LCD_BLINK_TIME	The time about LCD blink in RTC setting mode	500	ms
LcdBackOff()	Close LCD backlight	N/A	N/A
LcdBackOn()	Open LCD backlight	N/A	N/A
LedWorkOn()	Open D2	N/A	N/A
LedWorkOff()	Close D2	N/A	N/A

4.2 Function List

Prototype	Description	Remark
void Sys_Init (void)	System initialization	call in the system first
void StatusServeRun (void)	LED indication base on system status	N/A
void KeyScanf (void)	Key scan	N/A
void KeyTouchServe (void)	Judgment if have a key	N/A
void DispModeServe (void)	System status judgment	N/A
void MinSysCurTest (void)	Enter test mode	N/A
void RtcModeSet (void)	Enter RTC setting mode	N/A
void EnterLowerPowerModeProcess (void)	Enter low power consumption mode	N/A
void TscKeyScanf(void)	TSC key scan	N/A
uint8_t TSCKey_UpdateBaseline(uint8_t)	Update TSC base line	TSC Lib

4.3 Function Prototype

4.3.1 Sys_Init ()

Prototype	**void Sys_Init(void)**
Parameter:	void
Return	void
Description	Initialize system
Remark	N/A

4.3.2 StatusSeverveRun ()

Prototype	void StatusServeRun (void)
Parameter:	void
Return	void
Description	LED indication base on system status
Remark	N/A

4.3.3 KeyScanf()

Prototype	void KeyScanf (void)
Parameter:	void
Return	void
Description	Key scan
Remark	N/A

4.3.4 KeyTouchServe ()

Prototype	void KeyTouchServe (void)
Parameter:	void
Return	void
Description	Judgment if have a key
Remark	N/A

4.3.5 DispModeServe ()

Prototype	void DispModeServe (void)
Parameter:	void
Return	void
Description	System status judgment
Remark	N/A

4.3.6 MinSysCurTest()

Prototype	void MinSysCurTest (void)
Parameter:	void
Return	void
Description	Enter test mode
Remark	N/A

4.3.7 RtcModeSet()

Prototype	void RtcModeSet (void)
Parameter:	void
Return	void
Description	Enter RTC setting mode
Remark	N/A

4.3.8 EnterLowerPowerModeProcess ()

Prototype	void EnterLowerPowerModeProcess (void)
Parameter:	void
Return	void
Description	Enter low power consumption mode
Remark	N/A

4.3.9 TscKeyScanf ()

Prototype	void TscKeyScanf(void)
Parameter:	void
Return	void
Description	TSC key scan
Remark	N/A

4.3.10 uint8_t TSCKey_UpdateBaseline(uint8_t)

Prototype	uint8_t TSCKey_UpdateBaseline(uint8_t Key_Num)
Parameter:	Key_Num: Indication the number of touch keys need filter
Return	1 -- OK other -- Error
Description	Update TSC base line
Remark	N/A

5 Event Function

Note: More information about RTC, refer to FUJITSU MCU-AN-510045-E-10.pdf.

5.1 Function List

Prototype	Description	Remark
void LcdBlc_Init(void)	Init LCD back light controller	N/A
void InitRTC(uint8_t)	Init RTC function	N/A
void LedWork_Init(void)	Init MCU status indication led, as GPIO output	N/A
void CommonDvc_Int(void)	Init common device, eg: LCD backlight, LED	N/A
void ModChgKey_Init(void)	Init mode change key, as GPIO input	N/A
void JoyKey_Init(void)	Init mode Joystick key, as GPIO input	N/A
void ShowPage1(void)	Display the "FUJITSU"	N/A
void TSCKey_Init(unsigned char)	TSC initialization	N/A
void ShowDatePage(void)	Display the page 2 eg: Year-Month-Day	N/A
void ShowTimePage(void)	Display the page 1 eg: Hour:Min:Sec	N/A
uint8_t LeapYearCheck(uint8_t)	Check the input year, if leap?	N/A
void LcdBuffer_Clr(void)	Clean LCD display buffer	N/A
void LcdWriteData(uint8_t, uint8_t, uint8_t)	Write data to LCD display buffer	N/A
void LcdWriteColon(uint8_t)	Write colon to LCD display buffer	N/A
void LcdDisp_Clr(void)	Clean the LCD display	N/A
void ShowWhichPlaceBlink(uint8_t, uint8_t, uint8_t)	Appoint a place, the display is blink	N/A
void TimePageSet(uint8_t, uint8_t , uint8_t)	In setting time mode, display the page 1 eg: Hour:Min:Sec	N/A
void DatePageSet(uint8_t, uint8_t , uint8_t)	In setting time mode, display the page 2 eg: Year-Month-Day	N/A
void SetAllGpioOutH(void)	Set GPIO status for low power consumption mode	N/A

5.2 Function Prototype

5.2.1 LcdBlc_Init ()

Prototype	void LcdBlc_Init(void)
Parameter:	void
Return	void
Description	Init LCD back light controller
Remark	N/A

5.2.2 InitRTC(uint8_t)

Prototype	void InitRTC(uint8_t EnableWriteRtc)
Parameter:	EnableWriteRtc: Enable write the date & time 0x1 -- enable other -- disable
Return	void
Description	Initialize RTC function
Remark	N/A

5.2.3 LedWork_Init ()

Prototype	void LedWork_Init(void)
Parameter:	void
Return	void
Description	Init MCU status indication led, as GPIO output
Remark	N/A

5.2.4 CommonDvc_Init ()

Prototype	void CommonDvc_Init(void)
Parameter:	void
Return	void
Description	Init common device, eg: LCD backlight, Beep, LED
Remark	N/A

5.2.5 ModChgKey_Init()

Prototype	void ModChgKey_Init(void)
Parameter:	void
Return	void
Description	Init mode change key, as GPIO input
Remark	N/A

5.2.6 JoyKey_Init ()

Prototype	void JoyKey_Init(void)
Parameter:	void
Return	void
Description	Init mode Joystick key, as GPIO input
Remark	N/A

5.2.7 ShowPage1 ()

Prototype	void ShowPage1(void)
Parameter:	void
Return	void
Description	Display the "FUJITSU"
Remark	N/A

5.2.8 TSCKey_Init()

Prototype	void TSCKey_Init(unsigned char)
Parameter:	void
Return	void
Description	TSC initialization
Remark	N/A

5.2.9 ShowDatePage()

Prototype	void ShowDatePage(void)
Parameter:	void
Return	void
Description	Display the page 2 eg: Year-Month-Day
Remark	N/A

5.2.10 ShowTimePage()

Prototype	void ShowTimePage(void)
Parameter:	void
Return	void
Description	Display the page 1 eg: Hour:Min:Sec
Remark	N/A

5.2.11 uint8_t LeapYearCheck(uint8_t)

Prototype	uint8_t LeapYearCheck(uint8_t Year)
Parameter:	Year: input the year
Return	1 -- year other -- not
Description	Check the input year, if leap?
Remark	N/A

5.2.12 LcdBuffer_Clr()

Prototype	void LcdBuffer_Clr(void)
Parameter:	void
Return	void
Description	Clean LCD display buffer
Remark	N/A

5.2.13 LcdWriteData(uint8_t, uint8_t, uint8_t)

Prototype	void LcdWriteData(uint8_t dat, uint8_t place, uint8_t point)
Parameter:	dat: needs display data place: place of display point: if display radix point 1 -- yes other -- no
Return	void
Description	Write data to LCD display buffer
Remark	N/A

5.2.14 LcdWriteColon(uint8_t)

Prototype	void LcdWriteColon(uint8_t place)
Parameter:	place: display place
Return	void
Description	Write colon to LCD display buffer
Remark	N/A

5.2.15 LcdDisp_Clr()

Prototype	void LcdDisp_Clr (void)
Parameter:	void
Return	void
Description	Clean the LCD display
Remark	N/A

5.2.16 ShowWhichPlaceBlink(uint8_t, uint8_t, uint8_t)

Prototype	void ShowWhichPlaceBlink(uint8_t WhichPlace, uint8_t ReplaceDate1, uint8_t ReplaceDate2)
Parameter:	Place: place of blink display ReplceDate1: needs replace data in place ReplceDate2: needs replace data in place+1
Return	void
Description	A point a place, the display is blink
Remark	N/A

5.2.17 TimePageSet(uint8_t, uint8_t, uint8_t)

Prototype	void TimePageSet(uint8_t hour, uint8_t min, uint8_t sec)
Parameter:	hour: the current hour min: the current minute sec: the current second
Return	void
Description	In setting time mode, display the page 1 eg: Hour:Min:Sec
Remark	N/A

5.2.18 DatePageSet(uint8_t, uint8_t, uint8_t)

Prototype	void DatePageSet(uint8_t year, uint8_t month, uint8_t date)
Parameter:	year: the current year month: the current month date: the current day
Return	void
Description	In setting time mode, display the page 2 eg: Year-Month-Day
Remark	N/A

5.2.19 SetAllGpioOutH()

Prototype	void SetAllGpioOutH(void)
Parameter:	void
Return	void
Description	Set GPIO status
Remark	N/A

6 Driver Function

Note: More information about RTC, refer to FUJITSU MCU-AN-510045-E-10.pdf.

6.1 Function List

Prototype	Description	Remark
void Gpio_Init(McuPinName, uint8_t, uint8_t)	Set a GPIO pin as input or output	N/A
uint8_t GpioInputCheck (McuPinName, uint8_t)	When a pin used as GPIO input, check if a key	N/A
uint8_t MultiAdcFun(McuPinName)	Judgment if the pin has ADC function	N/A
uint8_t MultiLcdFun(McuPinName)	Judgment if the pin has LCD function	N/A
uint8_t MultiMainClockFun(McuPinName)	Judgment if the pin has Main clock function	N/A
uint8_t MultiSubClockFun(McuPinName)	Judgment if the pin has sub clock function	N/A
void LcdComPin_Int(uint8_t)	Base on hardware connect init the com pin	N/A
void LcdSegPin_Int(void)	Base on hardware connect init segment pin	N/A
void LCD_Init(void)	Init LCD controller	N/A
void LCD_Disable(void)	Disable LCD function	N/A
void LcdDisp(void)	Display the buffer data to LCD	N/A
void BT0ReloadTimer_Init(void)	Init BT0 as reload timer, 1ms	N/A
void BT0Timer_Halt(void)	Stop the BT0 as timer	N/A
void BT0Timer_Resume(void)	Resume the BT0 as timer	N/A
void Eint_Init(McuPinName, uint8_t)	Init extern interrupt	N/A
void Eint_Disable(McuPinName)	Disable appointed extern interrupt	N/A
void Lvd_Init(void)	LVD initialization, if fall to 4V, LVD interrupt	N/A

6.2 Function Prototype

6.2.1 Gpio_Init (McuPinName, uint8_t, uint8_t)

Prototype	void Gpio_Init (McuPinName WhichPin, uint8_t Dir, uint8_t Level)
Parameter:	WhichPin: The GPIO pin Dir: 1 -- output 0 -- input Level: When output: 0 -- low level 1 -- high level 2 -- high level and Hi-Z When input: 0 -- not connect pull-up resistor 1 -- connect pull-up resistor
Return	void
Description	Set a GPIO pin as input or output
Remark	N/A

6.2.2 uint8_t GpioInputCheck(McuPinName, uint8_t)

Prototype	uint8_t GpioInputCheck (McuPinName WhichPin, uint8_t TouchValueVolt)
Parameter:	WhichPin: The GPIO pin TouchValueVolt: When Key touching, the voltage value
Return	uint8_t: 1 -- has a touch other -- has not a touch
Description	When a pin used as GPIO input, check if a key
Remark	N/A

6.2.3 uint8_t MultiAdcFun(McuPinName)

Prototype	uint8_t MultiAdcFun(McuPinName WhichPin)
Parameter:	WhichPin: The GPIO pin
Return	uint8_t: 1 -- yes other -- not
Description	Judgment if the pin has ADC function
Remark	N/A

6.2.4 uint8_t MultiLcdFun (McuPinName)

Prototype	uint8_t MultiLcdFun(McuPinName WhichPin)
Parameter:	WhichPin: The GPIO pin
Return	uint8_t: 1 -- yes other -- not
Description	Judgment if the pin has LCD function
Remark	N/A

6.2.5 uint8_t MultiMainClockFun(McuPinName)

Prototype	uint8_t MultiMainClockFun(McuPinName WhichPin)
Parameter:	WhichPin: The GPIO pin
Return	uint8_t: 1 -- yes other -- not
Description	Judgment if the pin has Main clock function
Remark	N/A

6.2.6 uint8_t MultiSubClockFun(McuPinName)

Prototype	uint8_t MultiSubClockFun(McuPinName WhichPin)
Parameter:	WhichPin: The GPIO pin
Return	uint8_t: 1 -- yes other -- not
Description	Judgment if the pin has sub clock function
Remark	N/A

6.2.7 LcdComPin_Init (uint8_t)

Prototype	void LcdComPin_Init(uint8_t mode)
Parameter:	mode: LCD mode select 8 -- 8 com 4 -- 4 com other value is invalid
Return	void
Description	Base on Hardware connect init the com pin
Remark	N/A

6.2.8 LcdSegPin_Init ()

Prototype	void LcdSegPin_Init(void)
Parameter:	void
Return	void
Description	Base on Hardware connect init the segment pin
Remark	N/A

6.2.9 LCD_Init()

Prototype	void LCD_Init(void)
Parameter:	void
Return	void
Description	Init LCD controller
Remark	N/A

6.2.10 LCD_Disable ()

Prototype	void LCD_Disable(void)
Parameter:	void
Return	void
Description	Disable LCD function
Remark	N/A

6.2.11 LcdDisp()

Prototype	void LcdDisp(void)
Parameter:	void
Return	void
Description	Display the buffer data to LCD
Remark	N/A

6.2.12 BT0ReloadTimer_Init()

Prototype	void BT0ReloadTimer_Init(void)
Parameter:	void
Return	void
Description	Init BT0 as reload timer, 1ms
Remark	N/A

6.2.13 BT0Timer_Halt()

Prototype	void BT0Timer_Halt(void)
Parameter:	void
Return	void
Description	Stop the BT0 as timer
Remark	N/A

6.2.14 BT0Timer_Resume()

Prototype	void BT0Timer_Resume(void)
Parameter:	void
Return	void
Description	Resume the BT0 as timer
Remark	N/A

6.2.15 Eint_Init(McuPinName, uint8_t)

Prototype	void Eint_Init(McuPinName WhichPin, uint8_t trigger)
Parameter:	McuPinName: The MCU pin Trigger: 0 -- Low level detect 1-- High level detect 2 -- Rising edge detect 3 -- Falling edge detect
Return	void
Description	Init extern interrupt
Remark	N/A

6.2.16 Eint_Disable(McuPinName)

Prototype	void Eint_Disable(McuPinName WhichPin)
Parameter:	McuPinName: The MCU pin
Return	void
Description	Disable appointed extern interrupt
Remark	N/A

6.2.17 Lvd_Init()

Prototype	void Lvd_Init(void)
Parameter:	void
Return	void
Description	LVD initialization, detected voltage fall 4V, LVD interrupt
Remark	N/A

7 Interrupt Function

Note: More information about RTC, refer to FUJITSU MCU-AN-510045-E-10.pdf.

7.1 Function List

Prototype	Description	Remark
void BT_IRQHandler(void)	BT0 interrupt, 1ms per	N/A
void INT0_7_Handler(void)	Extern interrupt	N/A
void LVD_Handler(void)	Low power detection interrupt	N/A

7.2 Function Prototype

7.2.1 BT_IRQHandler()

Prototype	void BT_IRQHandler(void)
Description	BT0 interrupt, 1ms per
Content	BaseTimeCnt: Base timer counter, 1ms unit KeyDownCnt: Key touch counter, 1ms unit TouchModeCnt: Touch display mode counter, 1ms unit LcdBlinkCnt: LCD blink counter, 1ms unit LcdBlinkTimeCnt: LCD blink counter, used timer TscScanfCnt: TSC key scan time counter, 1ms unit PowerSupplyCnt: Judgment power voltage change timer
Remark	N/A

7.2.2 INT07_7_Handler()

Prototype	void INT0_7_Handler(void)
Description	Extern interrupt
Content	N/A
Remark	Used wake up MCU from low power consumption mode

7.2.3 LVD_Handler()

Prototype	void LVD_Handler(void)
Description	Low power detection interrupt
Content	PowerSupply: 0 -- 3.3V power 1 -- 5V power
Remark	N/A

8 Demo System

8.1 System Introduction

This sample project is designed to quick start evaluation of 8-COM segment LCD, enter & exit low power consumption modes and setting of RTC based on MB9AA30N series MCU. There are 3 different system modes, include normal mode, test mode and standby RTC display mode (low power consumption). Additionally, LEDs are used to indicate the MCU running status.

8.2 System Features

- MCU LCD controller driver
- RTC setting and calibration
- Enter and exit low power consumption
- Mechanical key and joystick driver
- TSC key base on TSC_Lib
- LVD used to control LCD display parameter

8.3 System Firmware Design

After power on, LCD displays “FUJITSU” lasts 3 s, runs normal mode and displays current time. Then press the key to enter other display modes.

- Normal mode

  Includes display current time and date, RTC setting and so on

- Test mode

  Include key and LED indication, enter and exit standby RTC mode in test mode

- Standby RTC mode (Low power consumption mode)

  Wake up and enter function

Refer to chapter 6 of MCU-UM-510106-E-11- Bluemoon-EVB_HW.

8.3.1 User Interface

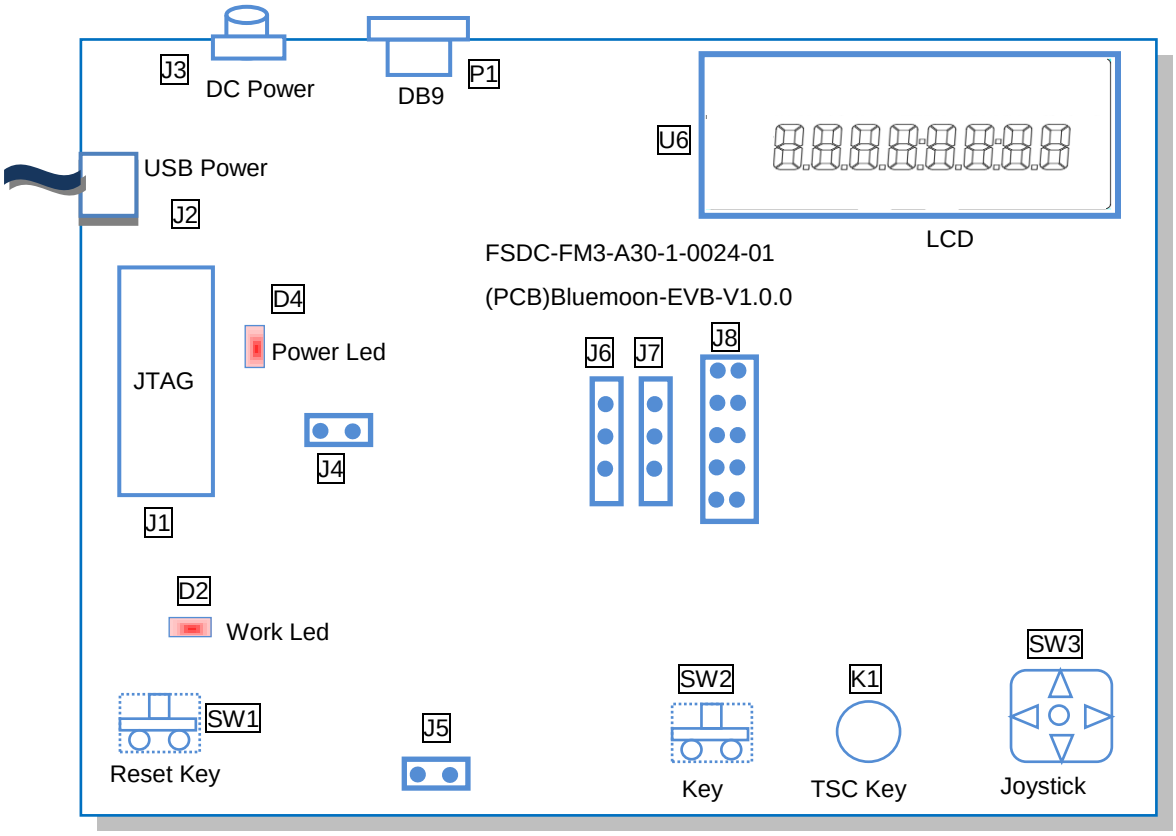

Figure 8-1: Demo System User Interface Block Diagram

8.3.2 System Main Loop

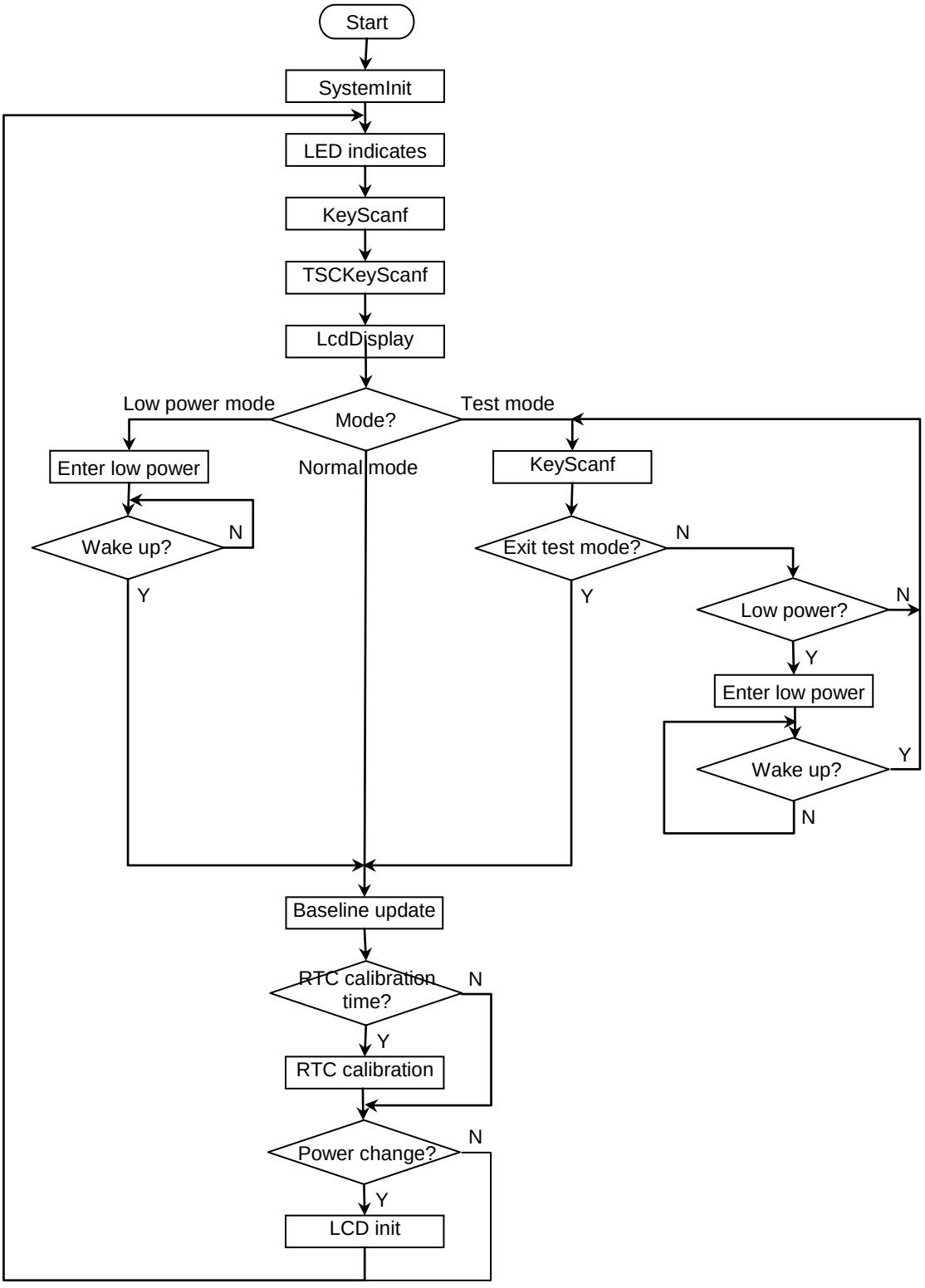

Figure 8-2: Demo System Main Loop Flowchart

8.3.3 System Files

In this application, there are 15 files: *common.c, common_device.c, lcd.c, lcd_device.c, TSC_ConfigInfo.c, adc12.c, isp.c, lpcm.c, lvd.c, rtc.c, calibration.c, lcd&rtc_serve.c, main.c, system_mb9afa3x.c, startup_mb9afa3x.s*

- *main.c*, includes main loop and MCU control functions.
- *common.c* & *common_device.c*, includes initialization of key, joystick, led and so on.
- *lcd.c* & *lcd_device.c*, includes initialization of LCD.
- *TSC_ConfigInfo.c*, includes TSC configuration information.
- *adc12.c*, includes initialization ADC function.
- *Isp.c*, includes LVD, timer, external interrupt.
- *lpcm.c*, includes relation function about low power consumption.
- *lvd.c*, includes relation function about low power detection
- *rtc.c*, includes relation function about RTC.
- *calibration.c*, includes RTC calibration.
- *lcd&rtc_serve.c*, includes difference system modes and so on.
- *system_mb9afa3x.c*, includes initialization or update MCU clock.
- *startup_mb9afa3x.s*, MCU start-up codes.

8.3.4 System Files Structure

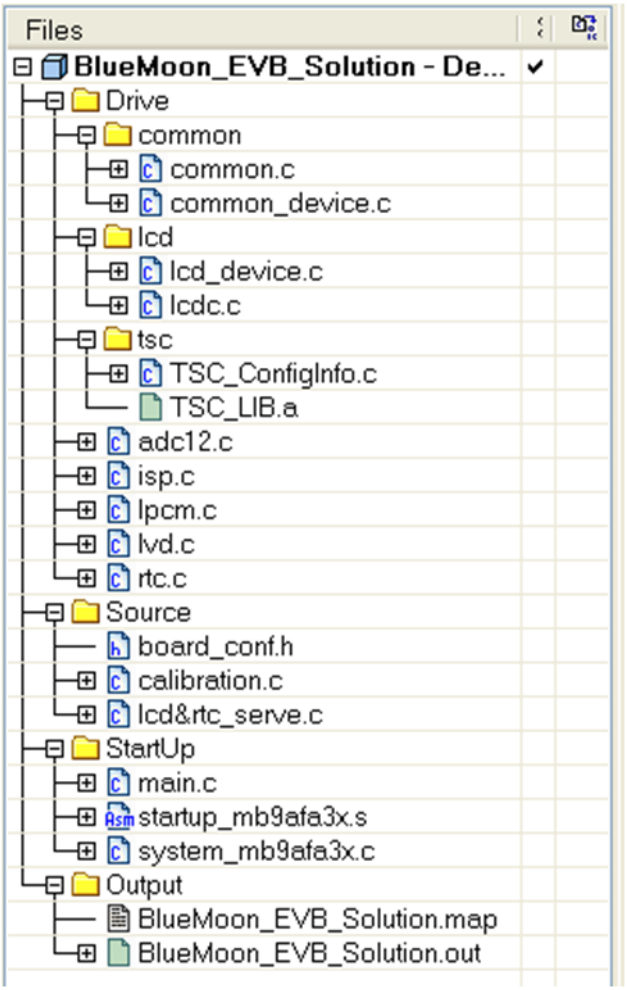

Figure 8-3: Sample Project Files Structure

9 Additional Information

For more Information on FUJITSU semiconductor products, visit the following websites:

English version address:

http://www.fujitsu.com/cn/fsp/services/mcu/32bit/fm3/an.html

Chinese version address:

http://www.fujitsu.com/cn/fss/services/mcu/32bit/fm3/an.html

10 Appendix

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