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AN204738

F²MC-8FX Family MB95200 Series 8-Bit Microcontroller Electronic Safe Demo Reference Solution

Associated Part Family: MB95200 Series

This application note describes the components and features of the Electronic Safe Demo set.

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1 Overview

Cypress Electronic Safe demo set which is based on Cypress MB95200 series is a high cost-effective solution.

It consists of the components below:

- 1 x main board with a MB95F214K
- 1 x 12-key keyboard
- 1 x electronic valve
- 1 x battery case for 4×5# batteries

This demo set supports these features:

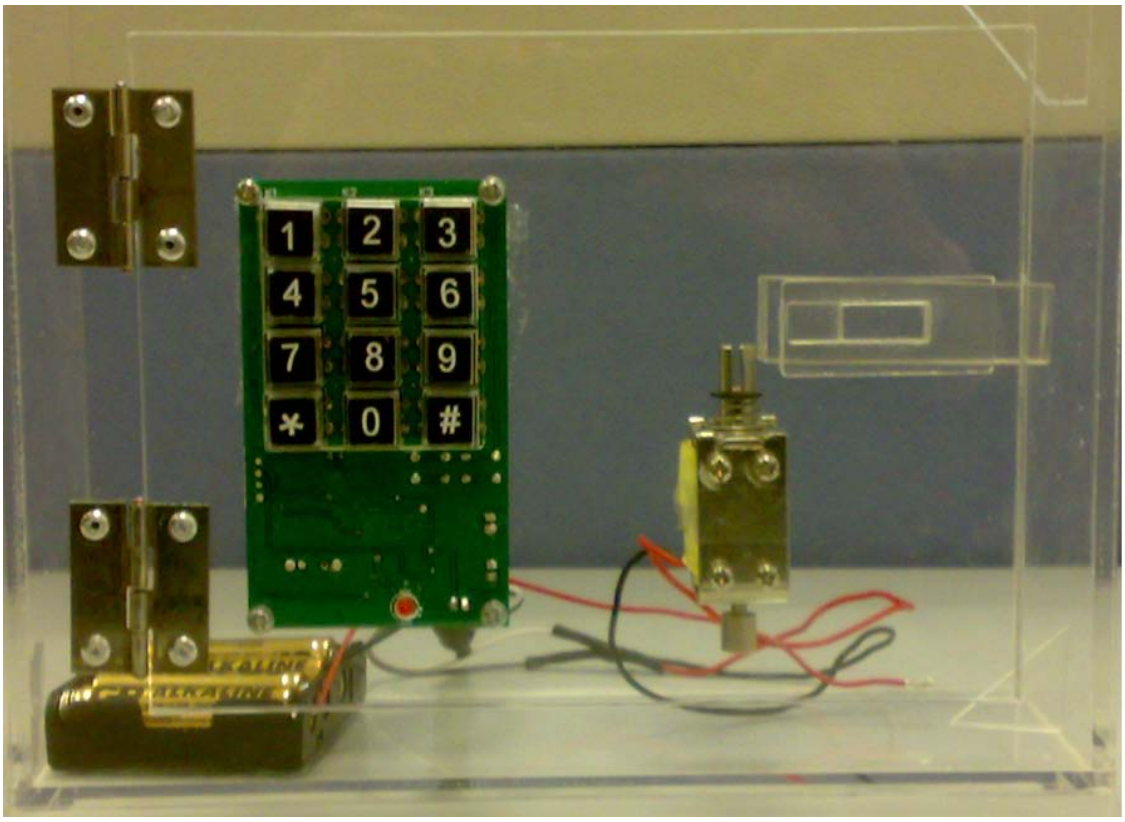
- Multiple password levels
- Alterable code length
- Operation and error indications
- Low battery capacity alarm
- Error lock
- Dual power supplies

2 Demo Platform

2.1 Platform

The electronic safe system consists of a main board which is combined with a 12-key board, an electronic valve and a battery case for 4 × 5# batteries.

Figure 1. Front of Electronic Safe Demo



3 Features

3.1 Multiple Password Level

The password has three levels of code: main code, user code and emergency code. They are ranked by priority from high to low. Each code is used independently.

3.2 Alterable Code Length

The code length is compatible from 6 to 12 bits.

3.3 Operation Indication and Error Alarm

In this system, a buzzer is used to indicate the operations or errors. When different keys are pressed or error occurs, the buzzer sounds differently to indicate the corresponding status.

1. 100ms on at 1 KHZ means key press.
2. 1s on at 500 HZ means correct operation.
3. 4 times of 100 ms on at 250 HZ and 50 ms off means incorrect operation.
4. 100ms on at 1 KHZ and 50 ms off in every 5 minutes means being in 15-minute-lock.

3.4 Low Battery Capacity Alarm

A LED is used to indicate the battery capacity.

1. Normal – LED keeps on.
2. Low – LED flashes at the frequency of 500 HZ continually.

3.5 Error Lock

The Safe will lock automatically for 30 seconds when enter an incorrect password 5 times or less, while when an incorrect password is entered for more than 5 times, the Safe will be locked for 15 minutes.

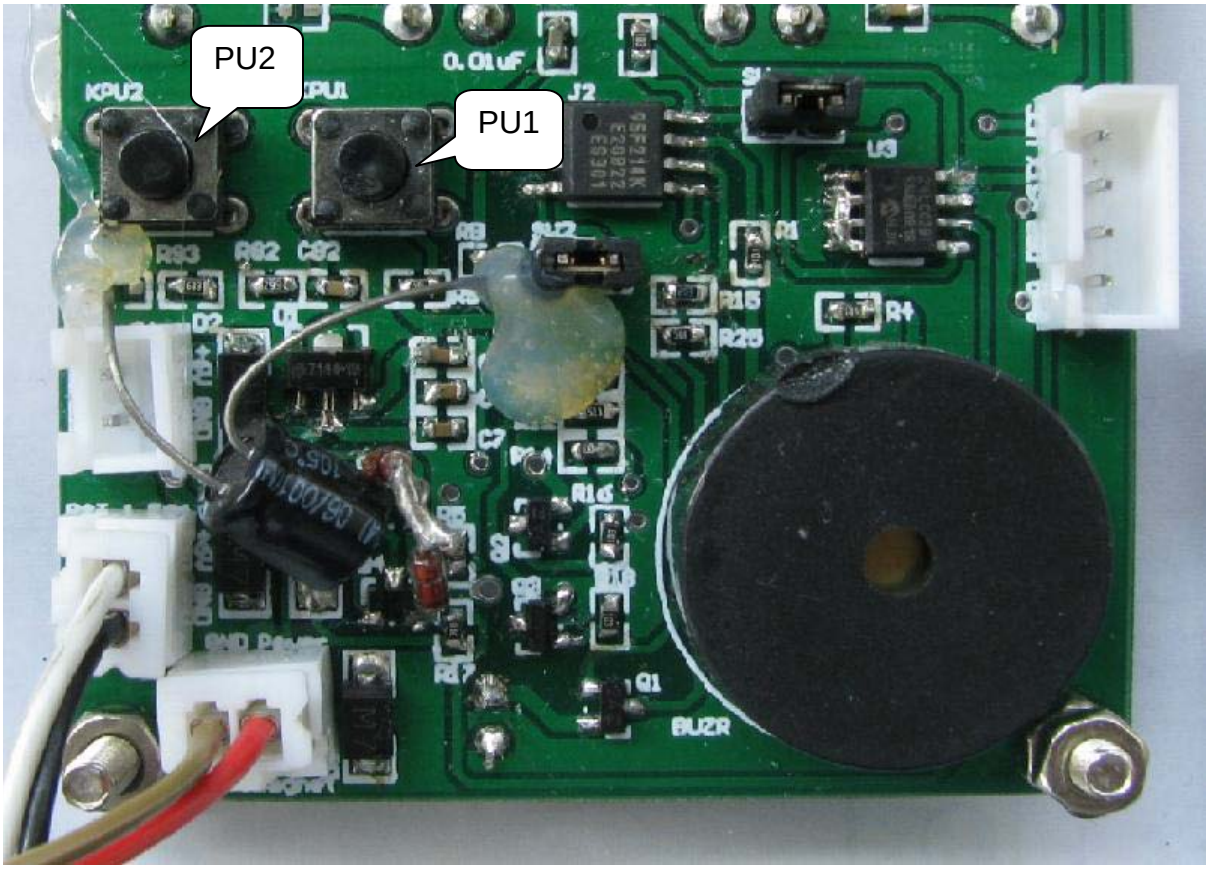
3.6 Dual Power Supply Source

When low battery capacity occurs, the power supply will shift to a backup battery package automatically. User can open the Safe to replace the main batteries first.

4 Functions

The Safe keeps sleeping until being waked up by pressing ***** or **PU1**, Figure 2 shows the back of the demo. **PU1** and **PU2** can be found on the back. In wake-up mode, an interval of longer than 5 seconds between two key-presses will switch the Safe to sleep mode. The main functions of this electronic Safe will be introduced as follow.

Figure 2. Back of Electronic Safe Demo



4.1 How to open the Safe

The Safe have three levels of password. When the Safe is powered on, user can enter a password according to the format below to open it.

1. Press [*].
2. Enter [password].
3. Press [#].

Example: [*] 123456 [#].

4.2 Main Code Operation

Condition: The Safe has been opened by main code.

4.2.1 Set main code

1. Press [*].
2. Enter [5][3].
3. Press [PU2].
4. Enter [main code] [#] twice.

Example: [*] [5][3] [PU2] [543210] [#] [543210] [#].

4.2.2 Modify main code

1. Press [*].
2. Press [0].
3. Press [PU1].
4. Enter [old main code] [#].
5. Enter [new main code] [#] twice.

Example: [*] [0] [PU1] [012345] [#] [543210] [#] [543210] [#].

4.3 User Code Operation

Condition: The Safe has been opened by main code or User code

4.3.1 Set user code

1. Press [PU1].
2. Enter [user code][#] twice.

Example: [PU1] [543210] [#] [543210] [#].

4.3.2 Modify user code

1. Press [*].
2. Press [1].
3. Press [PU1].
4. Enter [old user code] [#].
5. Enter [new user code] [#] twice.

Example: [*] [1] [PU1] [012345] [#] [543210] [#] [543210] [#].

4.4 Emergency Code

Condition: The Safe has been opened by main code or Emergency code.

4.4.1 Set emergency code

1. Press [*].
2. Enter [5][2].
3. Press [PU2].
4. Enter [emergency code][#] twice.

Example: [*] [5][2] [012345] [#] [012345] [#] .

4.4.2 Modify emergency code

1. Press [*].
2. Press [8].
3. Press [PU1].
4. Enter [old emergency code] [#].
5. Enter [new emergency code] [#] twice.

Example: [*] [8] [PU1] [012345] [#] [543210] [#] [543210] [#].

4.4.3 Cancel emergency code

1. Press [*].
2. Press [8].
3. Press [PU2].
4. Enter [1234567890] [#].

Example: [*] [8] [PU2] [1234567890] [#].

5 Hardware

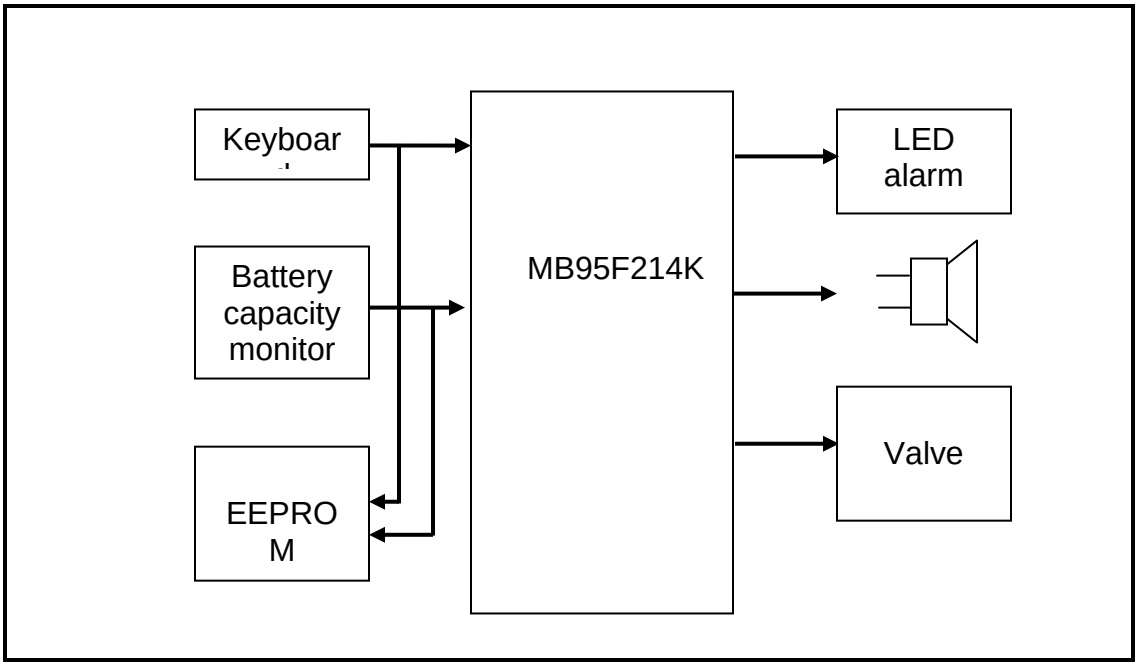
5.1 System Block

The whole system consists of 7 blocks:

- MCU
- Key input
- Electronic valve driver
- Power interface
- EEPROM
- Battery capacity monitoring and alarm
- Buzzer

A system block diagram is shown in Figure 3.

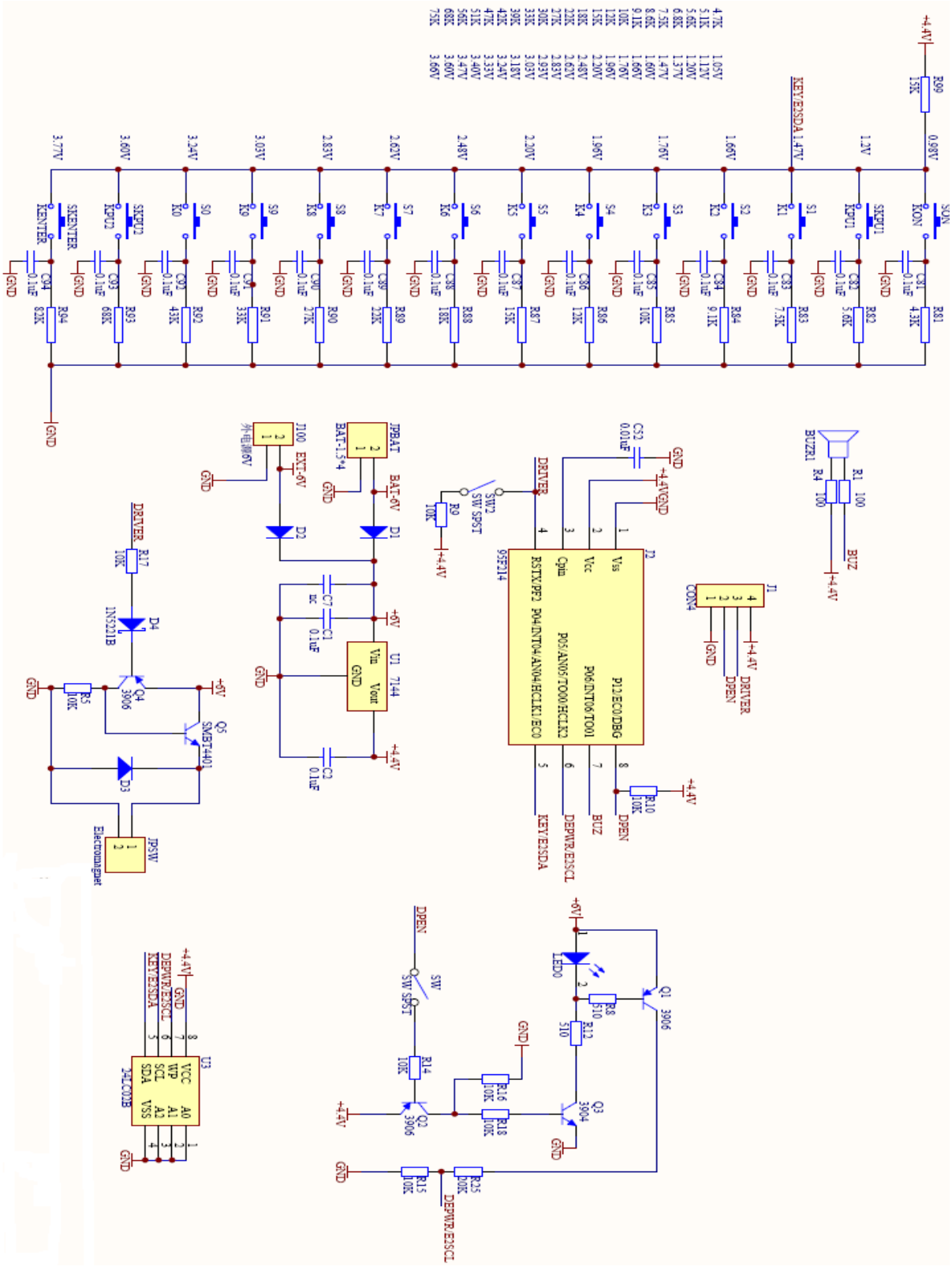
Figure 3. System Block Diagram



In this demo, many functions share the same pin and completed perfectly.

Please refer to Figure 4 for details (see next page).

Figure 4. Electronic Safe



5.2 Modules

- MCU

The MCU is MB95F214K, an 8 pins IC with 16 K bytes FLASH, 496 bytes RAM and 5 general I/Os.

Figure 5. MCU

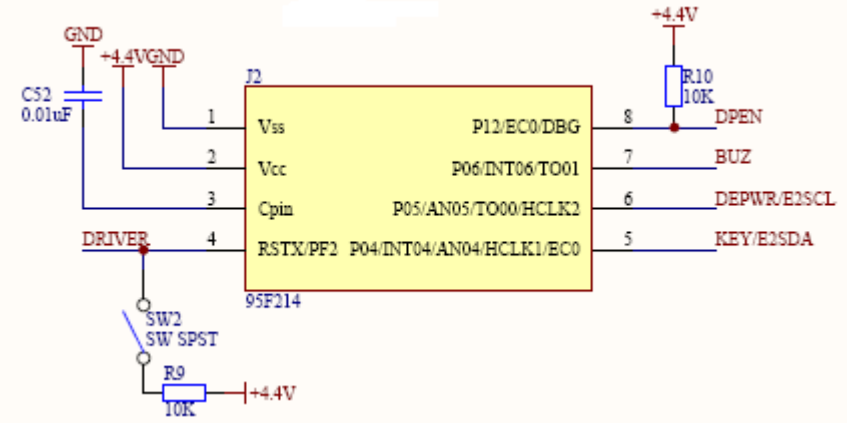


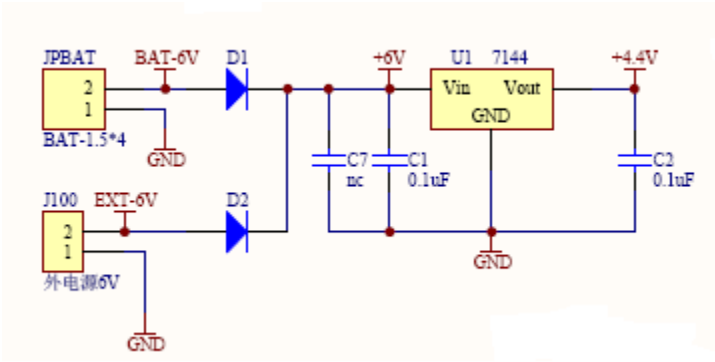
Table 1. Pin Function

Number	Pin	Direction	Function
4	RSTX/PF2	OUTPUT	Electronic valve drive
5	P04/INT04/AN04/HCLK1/EC0	INPUT	Key input, E2 SDA pin
6	P05/AN05/TO00/HCLK2	INPUT	Battery capacity monitoring,E2 SCL pin
7	P06/INT06/TO01	OUTPUT	Buzzer output
8	P12/EC0/DBG	OUTPUT	Battery capacity monitoring enable, LED

- Power interface

The demo has two power supplies. When the LED flashes to indicate low battery capacity, a backup battery package will work. User can open the Safe to replace the 5# batteries. D1 and D2 are used to prevent the counter current.

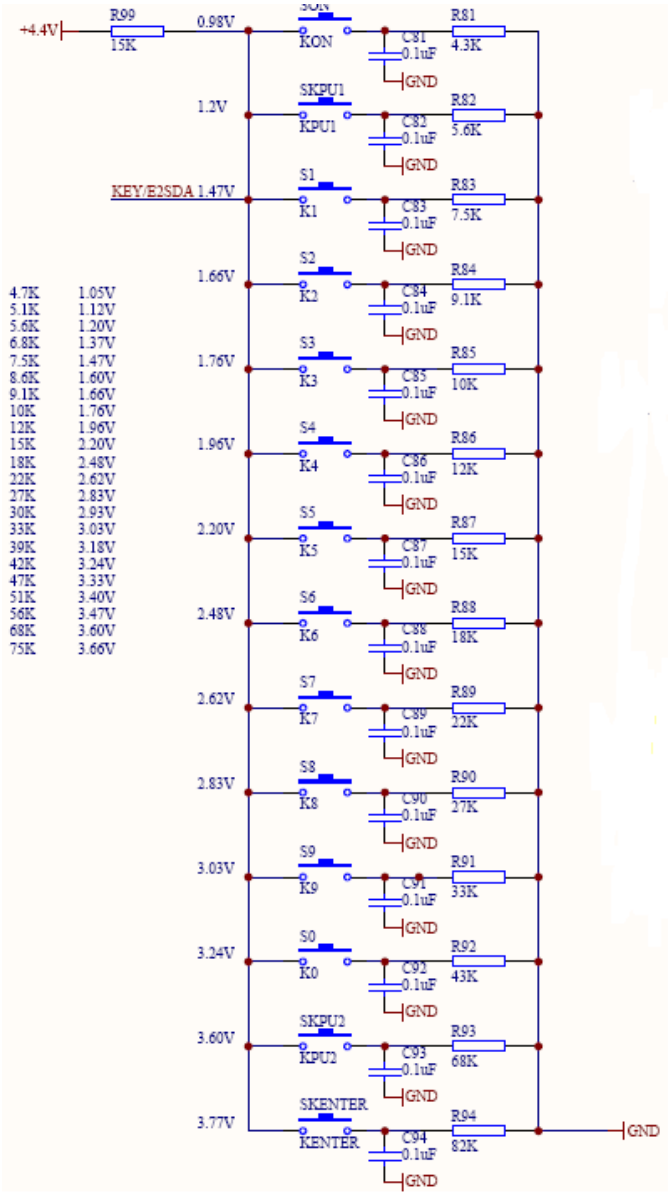
Figure 6. Power Interface



- Key input

  The key scan is implemented via only one AD channel. When MCU is sleeping, the pin acts as a general I/O to monitor the high-to-low eagle from key input that will produce an interrupt to wake the MCU up. After being waked up, the pin will be set to analog input for scanning keys.

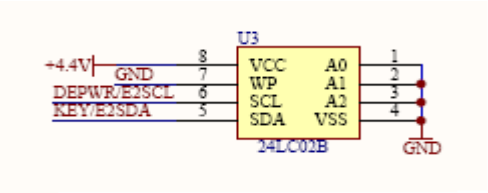
Figure 7. Key Input



- EEPROM

  The EEPROM shares pins with the key input and battery capacity monitoring. When the EEPROM is enabled, the pins act as I/O, otherwise they act as analog input. The EEPROM is used to store the passwords. For an unused Safe, the default passwords are 123456.

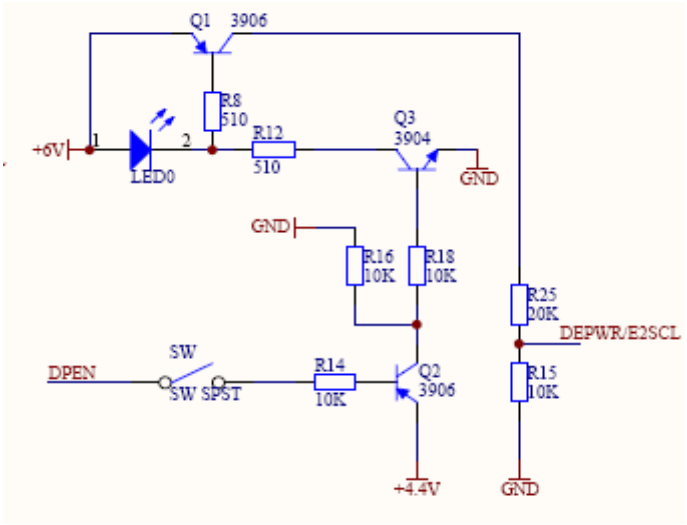
Figure 8. EEPROM



- Battery capacity monitoring and alarm

  This part has two functions. One is to control the LED, and another is to monitor the battery capacity. DPEN controls the whole circuit. When DPEN is set as 1, the circuit work, otherwise the circuit is disabled to save power. DEPWR is used to detect the battery capacity.

Figure 9. Battery Capacity Monitoring and Alarm

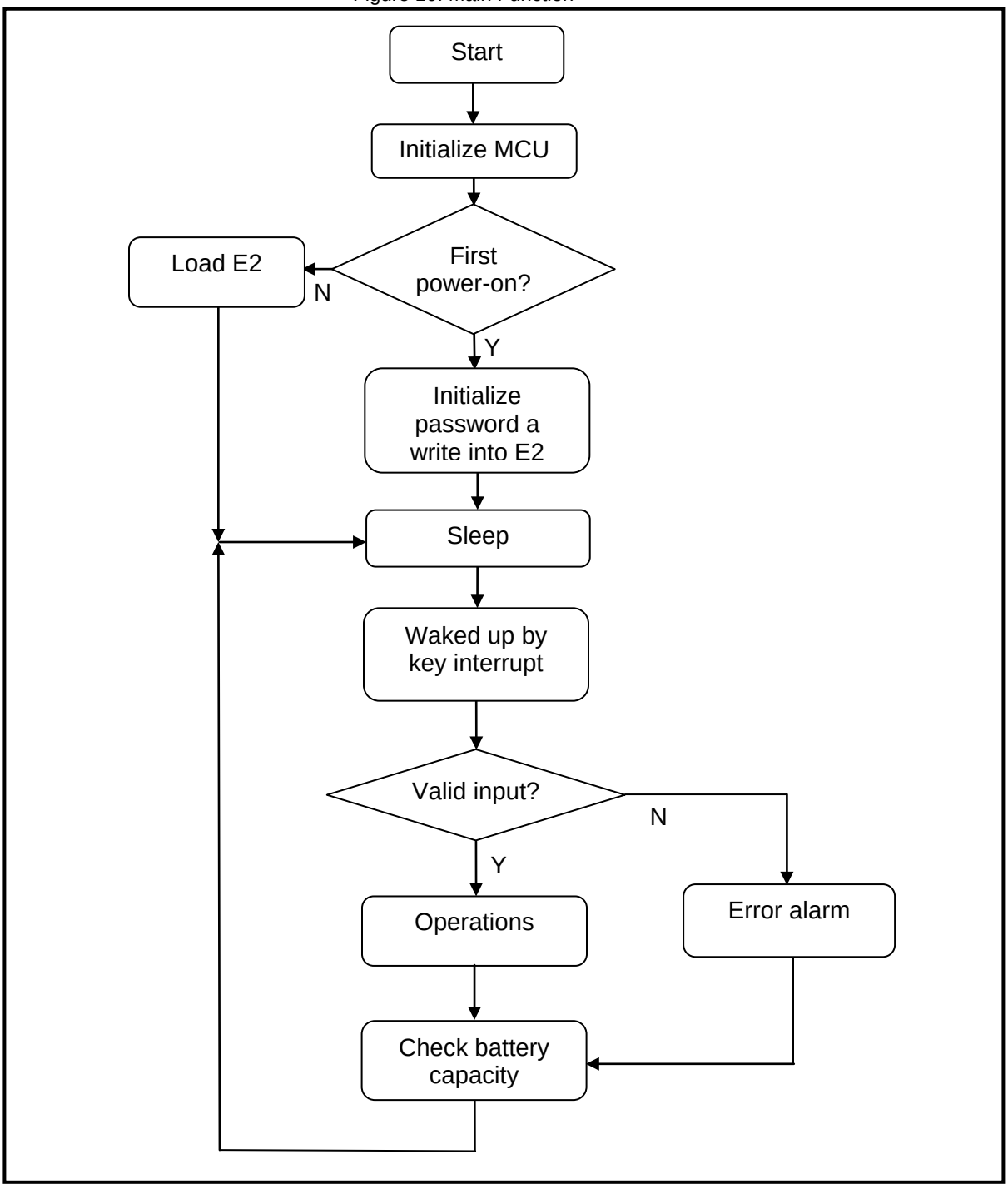


6 Firmware

6.1 Flow Chart of Main Function

Here, the flow chart of main function is given for reference.

Figure 10. Main Function



When routine starts, initialize the MCU first, then get the information of the Safe: is it a new Safe? If it is, a default password will be set and written into the external EEPROM; otherwise the password will be loaded from EEPROM. Then the Safe enters into sleep mode to save power till a key interrupt comes. In wake-up mode, if password was input, the safe will check the validity. If the input is valid, execute according operation, or Error alarm. Checking the battery capacity is the last function that will be executed every time. In the end, the Safe enters sleep mode.

6.2 Firmware Project

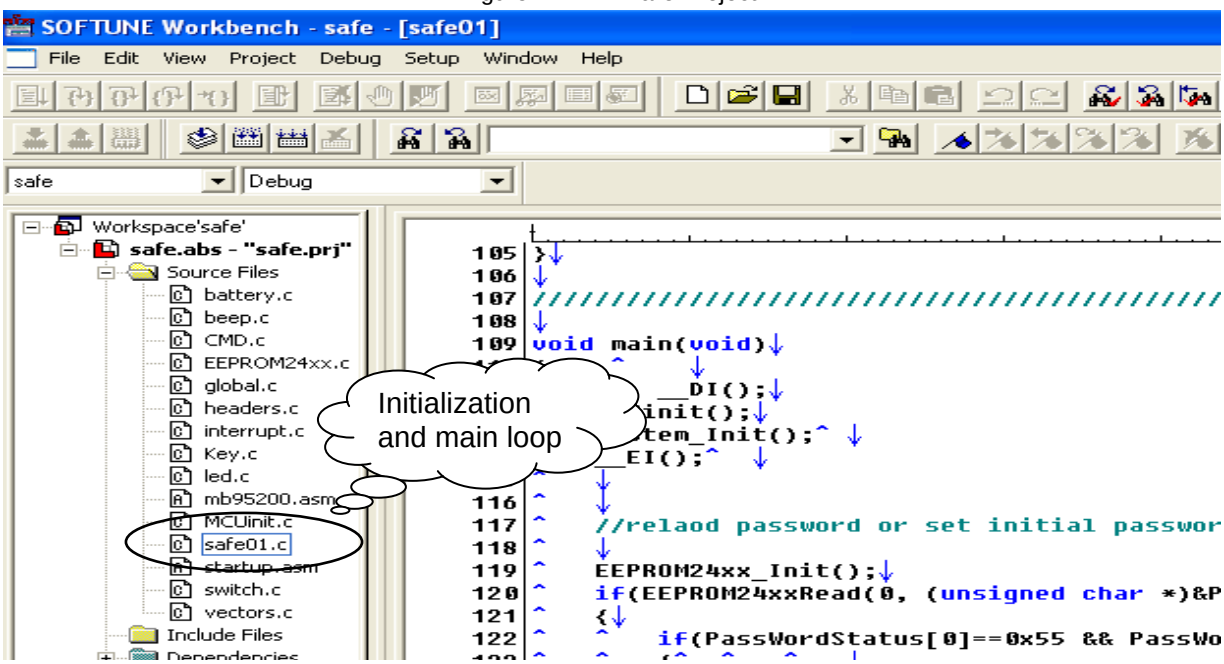
A table was given to explain the function of the main files below.

Table 2. Functions

Files	Function
safe01.c	Initialize MCU and do main loop
battery.c	Monitor battery capacity
beep.c	Buzzer
CMD.c	Switch internal modes
EEPRM24xx.c	Write or read EEROM
led.c	Led functions
key.c	Sample AD for key input
MCUinit .c	Initialize MCU
globe.c interrupt.c header.c	base timer subroutines
startup.asm	start files, just load for use
vector.c	vector configuration file
mb95200.asm	memory define, just load for use

Figure 11 is a project opened by SOFTUNE.

Figure 11. Firmware Project



7 More Information

For more information on Cypress MB95200 products, please visit following website:

http://www.cypress.com/MB95200

Document History

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Revision	ECN	Orig. of Change	Submission Date	Description of Change
**	-	HUAL	11/04/2009	Original version
*A	5235199	HUAL	05/18/2016	Migrated Spansion Application Note MCU-AN- 500056-E-10 to Cypress format.

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