

# LC823450XGEVK

## Low Power & High-Resolution Audio Processing System LSI Evaluation Board Firmware Writing Manual

### Overview

LC823450XGEVK is an evaluation board for LC823450 Series (called LC823450 hereafter) which is a low power & high-resolution audio processing system LSI for portable sound solution. This user's manual describes the method of writing firmware of the evaluation board.

Intended audience is customers who are building audio application using LC823450.

### Firmware Description

LC823450XGEVK can realize various functions by changing boot setting. Table 1 shows the list of functions depending on boot setting. You should select it depending on your desired function..

**Table 1. FUNCTIONS OF EACH BOOT SETTING**

|                                                                                                                                                                                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>Portable</u> <ul style="list-style-type: none"><li>• Standalone Playback with Hi-Resolution audio</li><li>• Standalone Recording with Noise Cancelling</li><li>• USB Audio Streaming Playback with Hi-Resolution audio</li><li>• USB Audio Streaming Recording with Hi-Resolution audio</li><li>• USB Mass Storage Class</li></ul> |
| <u>BT Headset</u> <ul style="list-style-type: none"><li>• A2DP Streaming from BT connected device</li><li>• Hands free talk with BT connected device</li><li>• Standalone Playback</li><li>• USB Mass Storage Class</li></ul>                                                                                                         |
| <u>BT Earbuds M/S</u> <ul style="list-style-type: none"><li>• A2DP Streaming with WS2 from Bluetooth connected device</li><li>• Standalone Playback with WS2</li><li>• USB Mass Storage Class</li></ul>                                                                                                                               |
| <u>BT speaker</u> <ul style="list-style-type: none"><li>• A2DP Streaming from Bluetooth connected device</li><li>• Standalone Playback</li><li>• USB Mass Storage Class</li></ul>                                                                                                                                                     |

### Boot Mode Select

LC823450XGEVK can select boot device either eMMC or SPI Serial FLASH by setting of two rotary switches, RSW1 and RSW2. Each boot device can realize same functions. Therefore, you should set two rotary switches depending on your selected firmware before power on as shown in Table 2 and Figure 1.



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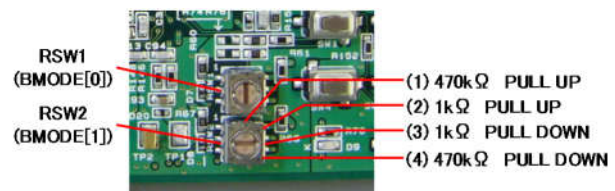
[www.onsemi.com](http://www.onsemi.com)

## EVAL BOARD USER'S MANUAL



**Table 2. BOOT MODE SETTING**

| Boot device      | RSW1 (BMODE0)                                  | RSW2 (BMODE1)         |
|------------------|------------------------------------------------|-----------------------|
| eMMC             | 470 k $\Omega$ PU (1)<br>470 k $\Omega$ PD (4) | 1 k $\Omega$ PD (3)   |
| SPI Serial FLASH | 1 k $\Omega$ PU (2)                            | 470 k $\Omega$ PD (4) |



**Figure 1. Rotary Switch**

### About Boot System

LC823450XGEVK has been adopted multi stage boot system.

The Initial Program Loader (IPL) which is implemented in internal ROM of LC823450, retrieves IPL2 from the boot device based on the BMODE[1:0] status just after hardware reset. If IPL finds the valid IPL2 in the boot device, IPL loads IPL2 to internal SRAM.

After IPL2 is loaded to internal SRAM, IPL2 retrieves application program from the boot device, and downloads it into internal SRAM.

Finally, application program is executed from internal SRAM.

In the case of eMMC boot, eMMC is used as the boot device and USB is used as the update device. Then, the Initial Program Loader 2 (IPL2) and application program are stored into eMMC, and LC823450 is booted from eMMC.

In the case of SPI Serial FLASH boot, SPI serial Flash is used as the boot device and SD Card is used as the update device. Then IPL2 and application program are stored into SPI serial Flash, and LC823450 is booted from SPI serial Flash.

In initial state after LC823450XGEVK shipping, an original IPL2 and some application program made by ON Semiconductor are stored into the boot device.

**Table 3. NAME OF IPL2**

| Mode                  | IPL2                                  |
|-----------------------|---------------------------------------|
| eMMC Boot             | LC8234xx_17S_start_data_emmc.boot_bin |
| SPI Serial FLASH Boot | LC8234xx_17S_start_data_spi.boot_bin  |

The naming rule of IPL2 is “LC8234xx\_17S\_start\_data\*.bin”.  
(\* means wild card)

**Table 4. NAME OF APPLICATION PROGRAM**

| Mode                  | Application program                |
|-----------------------|------------------------------------|
| eMMC Boot             | LC8234xx_17S_fw_data_emmc.boot_bin |
| SPI Serial FLASH Boot | LC8234xx_17S_fw_data_spi.boot_bin  |

The naming rule of application program is  
“LC8234xx\_17S\_fw\_data\*.bin”. (\* means wild card)

### Erase Device Select

In order to change or update the firmware in the boot device, you should erase it in advance. In this case, at first customers need to delete (or erase) the current IPL2 in boot device. The boot modes (delete/erase mode) described in Table 5 are used to delete or erase contents in the boot device corresponding to the boot device operation mode.

**Table 5. ERASE MODE SETTING**

| Mode            | RSW1<br>(BMODE0)    | RSW2<br>(BMODE1)      |
|-----------------|---------------------|-----------------------|
| eMMC Erase      | 1 k $\Omega$ PD (3) | 1 k $\Omega$ PD (3)   |
| SPI Flash Erase | 1 k $\Omega$ PU (2) | 470 k $\Omega$ PU (1) |

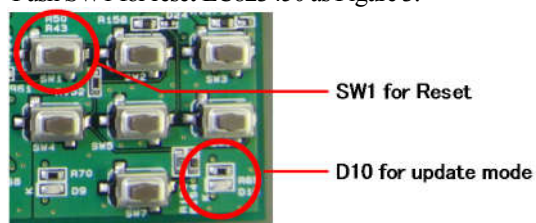
### Erase eMMC procedure

In order to change or update the firmware in eMMC as the boot device, you should erase it in advance. The erase procedure is as follows.

1. Set RSW1 and RSW2 as Figure 2.

**Figure 2. eMMC erase**

2. Connect USB cable to PC.
3. Push SW1 for reset LC823450 as Figure 3.

**Figure 3. SW1 and LED D10**

4. LC823450 executes erasing all area of eMMC.

5. During erasing eMMC, D10 as shown Figure 3 flashes on and off. It may takes about 1 minute.
6. If D10 will be in the lighting up state, erasure processing of eMMC is an end.

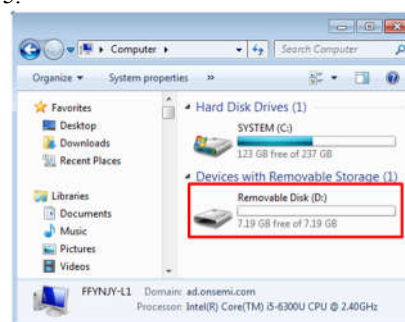
### Firmware writing to eMMC from USB

In order to store the firmware to eMMC on LC823450XGEVK, you should execute the firmware writing.

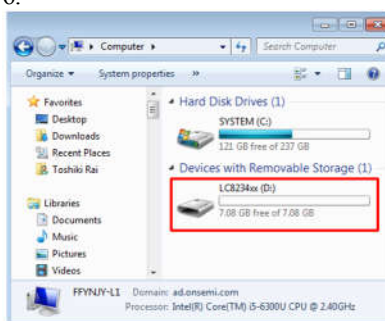
1. Set RSW1 and RSW2 as Figure 4.

**Figure 4. eMMC boot**

2. Push SW1 for reset LC823450.
3. eMMC is recognized by PC as “Removable Disk” as Figure 5.

**Figure 5. eMMC is recognized by PC**

4. Write the binary file, “LC8234xx\_17S\_start\_data\_emmc.boot\_bin” into the root directory of “Removable Disk”.
5. If the writing is completed, push SW1 and reset LC823450.
6. eMMC is not be recognized by PC and starts to execute IPL2.
7. It may take about 1 minute for format processing of eMMC.
8. eMMC is recognized again by PC as “LC8234xx” as Figure 6.

**Figure 6. eMMC is recognized by PC again**

9. Write the binary file, “LC8234xx\_17S\_fw\_data\_emmc.boot\_bin” into the root directory of “LC8234xx”.
10. If the writing is completed, push SW1 for reset LC823450.
11. LC823450 does not come to be recognized by PC and starts to execute updated firmware automatically.

### Erase SPI Serial FLASH procedure

In order to change or update the firmware in SPI Serial FLASH as the boot device, you should erase it in advance. The erase procedure is as follows.

1. Insert the SD card which is stored two binary files, “LC8234xx\_17S\_start\_data\_spi.boot\_bin” and “LC8234xx\_17S\_fw\_data\_spi.boot\_bin” to the root directory in advance.
2. Set RSW1 and RSW2 as Figure 7.



**Figure 7. SPI Serial FLASH erase**

3. Connect USB cable to PC.
4. Push SW1 for reset LC823450.
5. LC823450 executes erasing all area of SPI Serial FLASH.
6. During erasing SPI Serial FLASH, D10 flashes on and off. It may takes about 1 minute.
7. If D10 will be in the lighting up state, erasure processing of SPI Serial FLASH is an end.

### Firmware writing to SPI Serial FLASH from SD card

In order to store the firmware to SPI Serial FLASH on LC823450XGEVK, you should execute the firmware writing.

1. Set RSW1 and RSW2 as Figure 8.



**Figure 8. SPI Serial FLASH boot**

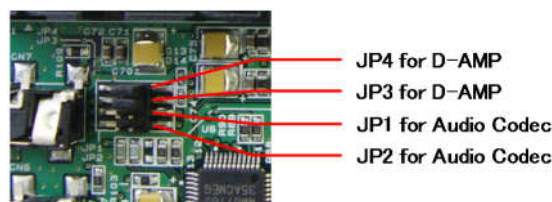
2. Push SW1 for reset LC823450.
3. Two binary files in the SD card are written into SPI Serial Flash automatically. It may take time for write processing of SPI Flash.
4. If the writing is completed, LC823450XGEVK resets by itself and starts to execute updated firmware automatically.

### Jumper Setting

LC823450XGEVK has two types of audio codec. One is a 16-bit 48 kHz stereo codec included in LC823450. It outputs the audio signal as D-AMP output of LC823450. The other is an external 24-bit 192 kHz stereo codec and it can deal with High Resolution Audio over 16-bit 48 kHz. It is connected to PCMIF0 on LC823450 and it is output to stereo head phone jack. Then, you can select either internal audio codec output or external audio codec output by setting jumper post as shown in Table 6 and Figure 9. If you select “FWbin\_UsbAudioClass1\_HiRes\_eMMC(USB)” as the firmware, you should set the jumper post to select external audio codec.

**Table 6. AUDIO OUTPUT SELECTION**

| Output      | JP1 | JP2 | JP3 | JP4 |
|-------------|-----|-----|-----|-----|
| Audio Codec | ON  | ON  | OFF | OFF |
| D-AMP       | OFF | OFF | ON  | ON  |



**Figure 9. Jumper post JP1, JP2, JP3 and JP4**

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