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Software Stack Readiness of LC823450 Series for Audio Applications

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APPLICATION NOTE

Introduction

This application note describes the software stack ON Semiconductor provide for quick and better understanding to enable customers to start designing audio applications timely.

Intended audience is customers who are building audio application using LC823450 Series (called LC823450 hereafter).

BACKGROUND

Sotware stack

We can provide customers with the software stack of LC823450 for audio applications as described in Figure 1. This stack consists of four layers of softwares (Application, Middleware, Library and Driver in the order of higher layer to lower layer) and Operating System (OS) as system software for the basic functions to control LC823450 platform.

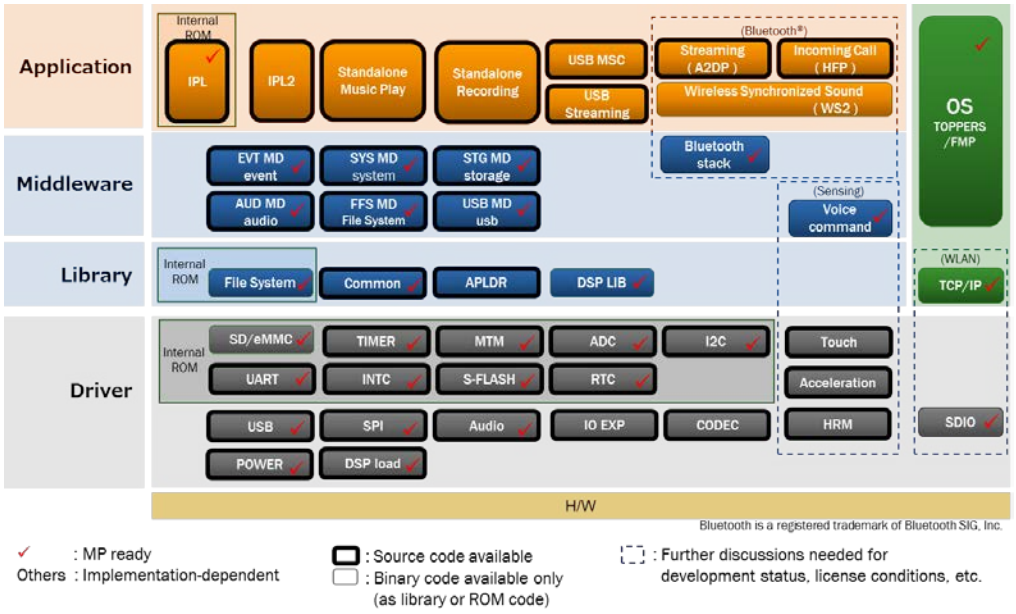
SOFTWARE STACK READINESS

Driver

Driver is the layer which enables upper layer programs to control H/W modules in LC823450 without accessing to the registers directly and so, programmers don't need to understand the registers in detail, and as a result, software development period will be expected to be shorter and upper layer programs can be easier to be reused and ported.

As described in Figure 1, some basic drivers such as INTC driver for Interrupt controller, TIMER driver for Plain timer and some peripheral drivers such as SD/eMMC driver for eMMC and SD Card access, USB driver for USB device connection to PC, and audio related drivers such as Audio driver for audio module control are availabe. Several drivers surrounded by a gray frame are included in internal ROM. The drivers with tick mark are ready for mass production, and we can provide as reference codes. Some drivers without tick mark are not ready for mass production because of user depending. We can provide source codes for some drivers, and updates to those drivers are allowed to realize user depending functions. Please note that we cannot guarantee the functions of updated drivers and readiness for mass production of those codes.

Figure 1. Software stack structure



Library

Library layer consists of File System, DSP LIB, Common, APLDR and the group of programs which should be widely used and useful function.

File System behaves as the access library to enable read from and write to the media such as eMMC compliant with FAT32 and exFAT file system without the detailed understanding of the specification of media. File System is included in internal ROM and ready for mass production.

DSP LIB is the group of DSP programs as described in Appendix A running on LPDSP32 integrated in LC823450. We can provide audio codec library such as AAC decoder, WMA decoder and effect function library such as Noise canceller, Center Focus. They are free and ready for mass production provided as binary code.

Common and APLDR are the useful function libraries such as string processing and F/W (that is user application program) update program respectively. Common library is ready for mass production, but APLDR is not ready due to user depending.

Middleware

Middleware layer is the group of programs to design audio applications on the layer.

1st one is EVTMD which is the event processing part of Middleware layer having API set enabling receiving three kind of events, Key events, USB events and SD card events. EVTMD sends request to SYSMD to process the events.

2nd one is SYSMD which gets request from EVTMD and distributes the request to AUDMD and USBMD based on the internal state of SYSMD and the contrent of request.

3rd one is STGMD which controls file access from AUDMD and USBMD by using Library layer and Driver layer.

4th one is AUDMD which is the core part of Middleware layer having Application Interface (API) set described in Table 1 enabling efficient designing of audio application software. AUDMD accesses to files through STGMD.

Table 1. API set of AUDMD (example)

API name	Function
AudMdIfInit	Initializing audio system
AudMdIfExit	Terminating audio system
AudMdIfPlay	Start playback
AudMdIfStop	Stop playback
AudMdIfFf	Fast Forward of playback
AudMdIfRew	Rewind of playback
AudMdIfSkipNext	Skip to next file
AudMdIfSkipPrev	Skip to previous file
AudMdIfPause	Pause playback
AudMdIfMediaFormat	Format drive
AudMdIfVolSet	Set playback volume
AudMdIfChangeDrive	Change drive

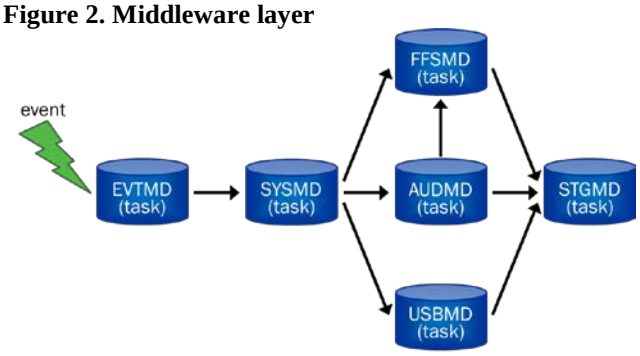
5th one is FFSMD which is a middleware to construct MS-DOS interchangeable file system (exFAT / FAT) on the device of the user system.

Last one is USBMD which controls the USB device connection to PC by using USB events from EVTMD received through SYSMD and accesses to files through STGMD.

These six middlewares are separated six tasks as described in Figure 2 and run concurrently by communicating with each other by exchanging requests.

We guarantee the middleware layer programs are ready for mass production while they should be modified according to the customer application specification.

Figure 2. Middleware layer



Application

Application layer is the group of programs to show the sample application programs which use lower layer programs as reference codes. We can provide source codes of sample applications, and updates are allowed to design customer applications. Please note that we cannot guarantee the functions of updated application programs and readiness for mass production of them. Only IPL is integrated in internal ROM and ready for mass production even though we cannot provide the source code of it.

OS

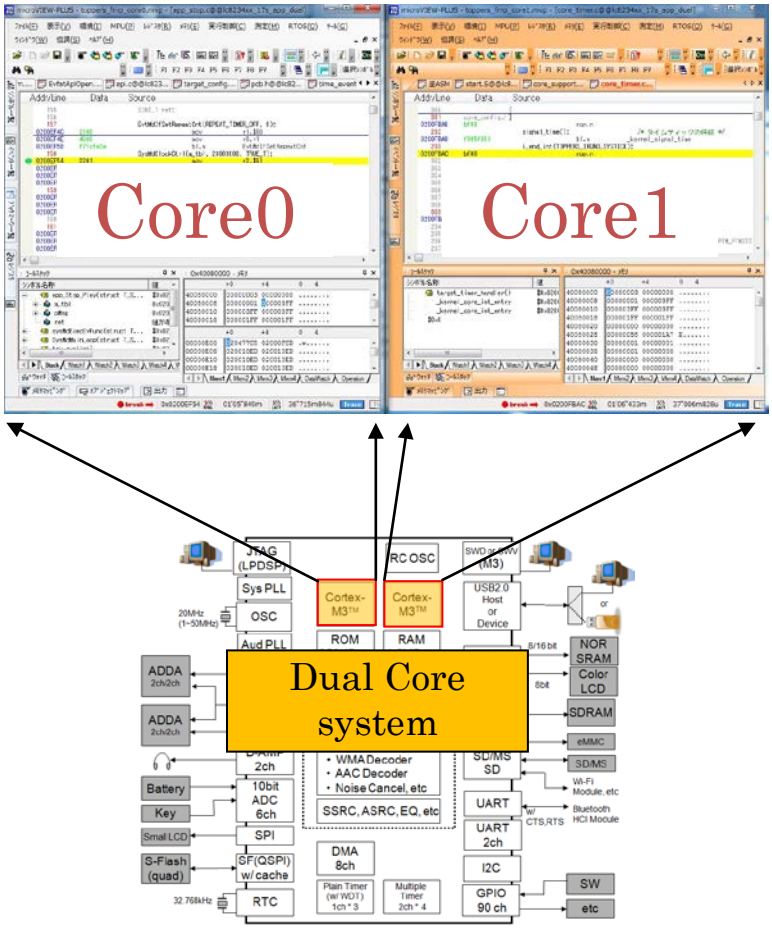
Besides four middle layers, we can provide OS as binary codes called TOPPERS/FMP which conforms to uITRON4 standard profile designed as the operating system for embedded system and supports dual core system as Figure 2. It is ready for mass production, but if customers have their own OS, it is possible to use it.

Bluetooth stack and SDIO driver

Regarding Bluetooth stack and SDIO driver required for wireless LAN communication, we are ready to provide and can support them, but because they are user depending and need the contracts and meet the conditions, we need further discussions before providing.

We can provide the software stack after making the appropriate contracts (NDA, etc) for the stack.

Figure 3. Dual Core on TOPPERS/FMP (degugger display example)



Block Diagram of LC823450

Appendix A

audio codec library on LPDSP32 (example)	
MP3* encoder	MPEG1/2/2.5 Layer3. Stereo/Mono 8 to 320 kbps 8/11.025/12/16/22.05/24/32/44.1/48 kHz
MP3* decoder	
WMA* decoder	WMA Ver9 Standard (Voice, Pro, Lossless are not supported) 5 to 320 kbps 8/11.025/16/22.05/32/44.1/48 kHz
AAC* decoder	AAC-LC / HE-AACv1 / HE-AACv2 8 to 320 kbps 8/11.025/12/16/22.05/24/32/44.1/48 kHz
FLAC* decoder	To 192 kHz, to 24-bit, 2-ch, subset

effect function library on LPDSP32 (example)	
Noise canceller	Sampling Frequency : 8 kHz to 48 kHz Channel : 1(mono) / 2(stereo) HPF
Center focus	Sampling Frequency : 8 kHz to 48 kHz Channel : 1(mono) / 2(stereo)
Compressor	Sampling Frequency : 8 kHz to 48 kHz Channel : 1(mono) / 2(stereo)

* MP3
  MPEG Layer-3 Audio Coding
* WMA
  Windows Media Audio
* AAC
  Advanced Audio Coding
* FLAC
  Free Lossless Audio Codec

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