USB Audio Decoder LSI Series
AAC/WMA/MP3 +SD Memory Card +CD-ROM+MP3 Record

BU94605AKV BU94607AKV BU94702AKV BU94705AKV

● Description

BU94605AKV BU94607AKV BU94702AKV BU94705AKV are MP3 encoder + WAV/AAC/WMA/MP3 decoder IC which contains program download function from external serial Flash ROM and contains USB host, SD card I/F, CD-ROM I/F, audio DAC, system controller, regulator for internal CORE power supply.

● Features

- USB2.0 Full Speed host I/F function contained.
- SD card I/F function contained.
- I^{2}C format I/F function contained.
- Protocol conversion from I^{2}C to USB HID or from USB HID to I^{2}C.   *1
- MP3 encode function contained. *2,*3,*10
- MP3 decode function contained. *4
- WMA decode function contained.   *5
- AAC decode function contained.   *6,*7
- WAV format file playing function contained. *7
- Sample Rate Converter contained.   *8
- System Controller contained.
- FAT analysis function contained.
- CD-ROM I/F function and CD-ROM decoder function contained.
- Browsing function of File Names, Folder Names on music playing contained.
- ID3TAG and WMATAG and AACTAG Analysis.
- Fast forward/backward playing function contained.
- Resume function contained.
- File data Reading/Writing function contained.
- Program download function from external serial Flash ROM contained.
- Audio DAC and Sound Effect function contained.
- Digital Audio Out function contained.   *9
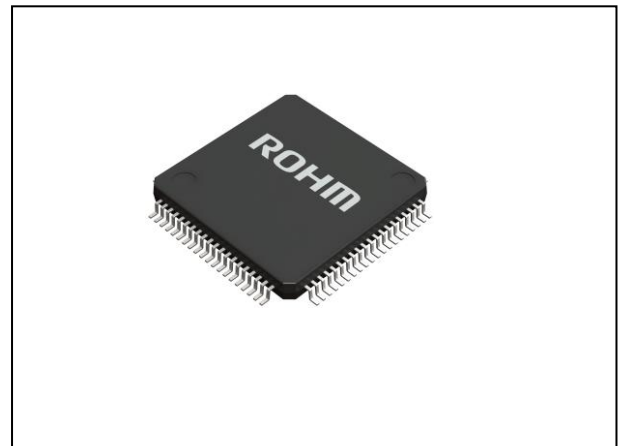- Regulator for internal CORE power supply contained.

● Applications

Audio products, etc

● Package

VQFP80   14.00mm x 14.00mm x 1.60mm

VQFP80

*1 BU94705AKV and BU94607AKV only.
*2 BU94705AKV and BU94702AKV only.
*3 Available for MPEG1, Layer3, support up to 2X inputspeed.
*4 Available for MPEG1, 2 and 2.5, Layer 1, 2 and 3.
*5 Available for WMA9 standard and not available for DRM.
*6 Available for MPEG4 AAC-LC and not available for DRM.
*7 Not available for CD-ROM.
*8 Convert to 44.1 kHz.
*9 Available for I^{2}S, EIAJ, S/PDIF format.
*10 Writing speed to the memory (USB memory, SD memory card) of the encoding data depends on the response speed of the memory greatly. Examine the memory which a connection is presumed fully, and limit the encoding format specifications of the set because real time encoding can't be realized when a writing response speed is slow.

● Line up

Part number	MP3 encoder	iPod	Package		Ordering part number
BU94605AKV	Not Supported	Not supported	VQFP80	Reel of 1000	BU94605AKV-E2
				Tray of 1000	BU94605AKV
BU94607AKV	Not Supported	Supported	VQFP80	Reel of 1000	BU94607AKV-E2
				Tray of 1000	BU94607AKV
BU94702AKV	Supported	Not supported	VQFP80	Reel of 1000	BU94702AKV-E2
				Tray of 1000	BU94702AKV
BU94705AKV	Supported	Supported	VQFP80	Reel of 1000	BU94705AKV-E2
				Tray of 1000	BU94705AKV

○Product structure:Silicon Monolithic integrated circuit   ○Radiation resistance design is not arranged

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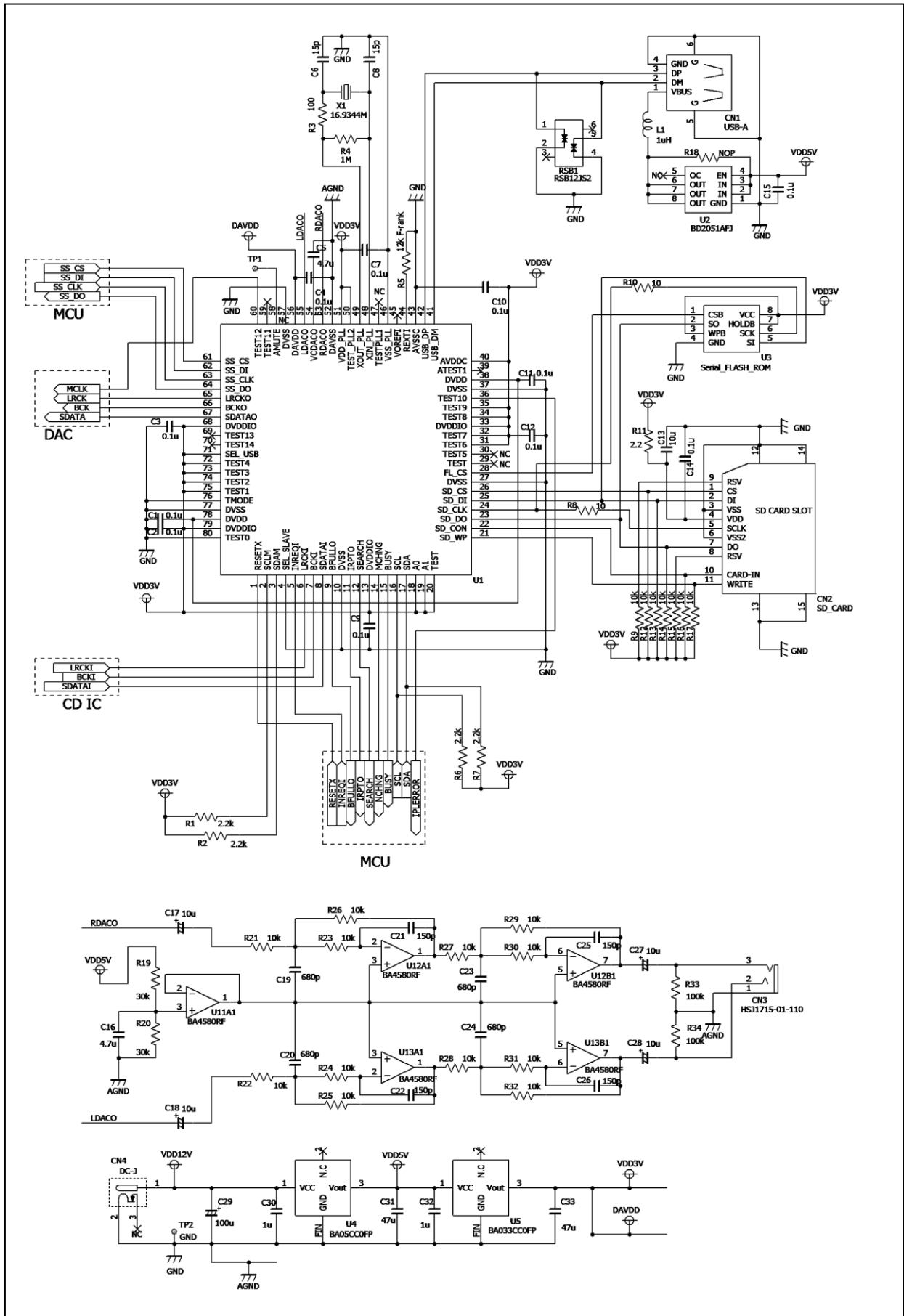
●**Basic circuit application diagram**

Figure 1. an example of connection circuit application

● **Difference of BU94605AKV BU94607AKV BU94702AKV BU94705AKV features**

Item	BU94605AKV	BU94607AKV	BU94702AKV	BU94705AKV
Package	VQFP80		VQFP80	
Number of pins	80pin		80pin	
Power supply	3.3V (inner 1.5V regulator)		3.3V (inner 1.5V regulator)	
USB Host I/F	USB Full speed(12Mbps), USB mass storage class		USB Full speed(12Mbps), USB mass storage class	
SD card I/F	SPI mode SD, SDHC, MMC, mini-SDcard		SPI mode SD, SDHC, MC, mini-SDcard	
iPod	Not supported	Supported *1	Not supported	Supported *1
MP3 encode	Not supported		Supported	
I^{2}C command I/F (Slave)	Supported		Supported	
Change the Setting of timeout and retry mode in USB memory or SD card mount operation	Supported		Supported	
Audio line output	Supported		Supported	
Digital audio output	I^{2}S, EIAJ, SPDIF		I^{2}S, EIAJ, SPDIF	
Sample rate convertor	Supported (44.1kHz)		Supported (44.1kHz)	
clock	16.9344MHz (*1)		16.9344MHz (*1)	
Playable MP3 files	*.mp3, *.mp2, *.mp1		*.mp3, *.mp2, *.mp1	
Playable WMA files	*.asf, *.wma		*.asf, *.wma	
Playable AAC files	*.m4a, *.3gp, *.mp4		*.m4a, *.3gp, *.mp4	
Playable WAV files	*.wav		*.wav	
Browsing function	Supported		Supported	
File writing function	Supported		Supported	
File reading function	Supported		Supported	
Play List function	Supported		Supported	

*1 for using of BU94607AKV and BU94705AKV, It is necessary to become a licensee of Apple Inc. regarding "Made for iPod/iPhone/iPad License".
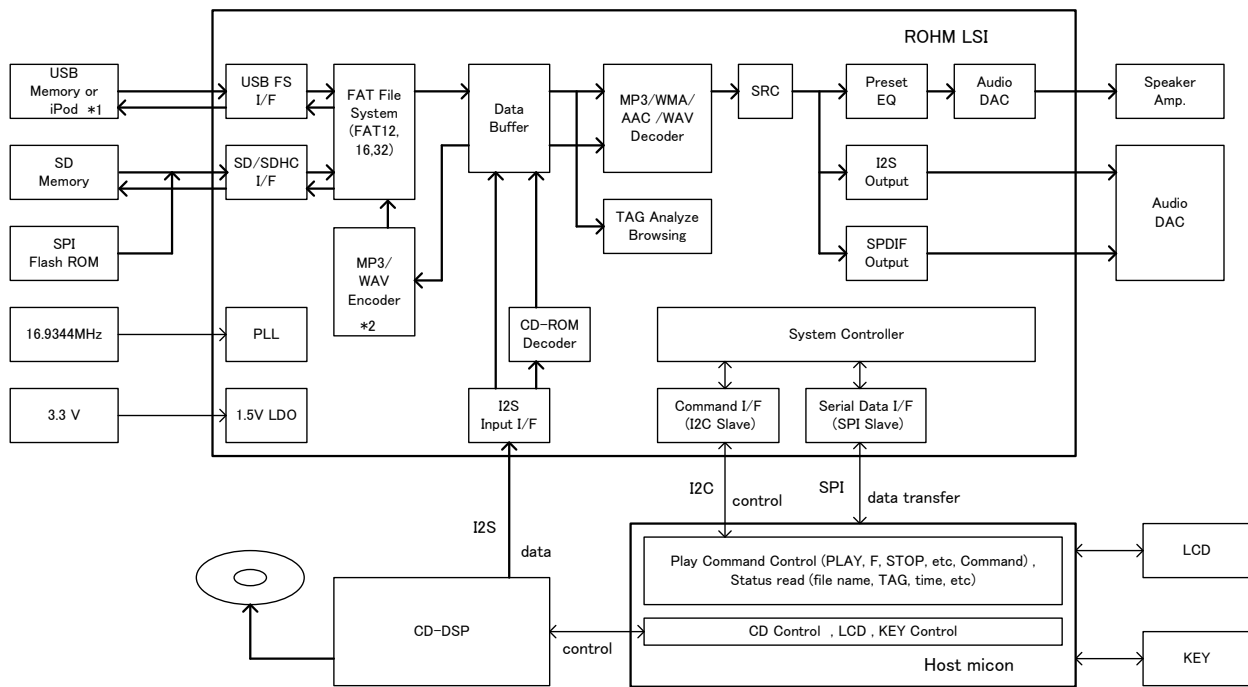
●**Block diagram**

Figure 2. Block diagram

*1 BU94705AKV and BU94607AKV only.
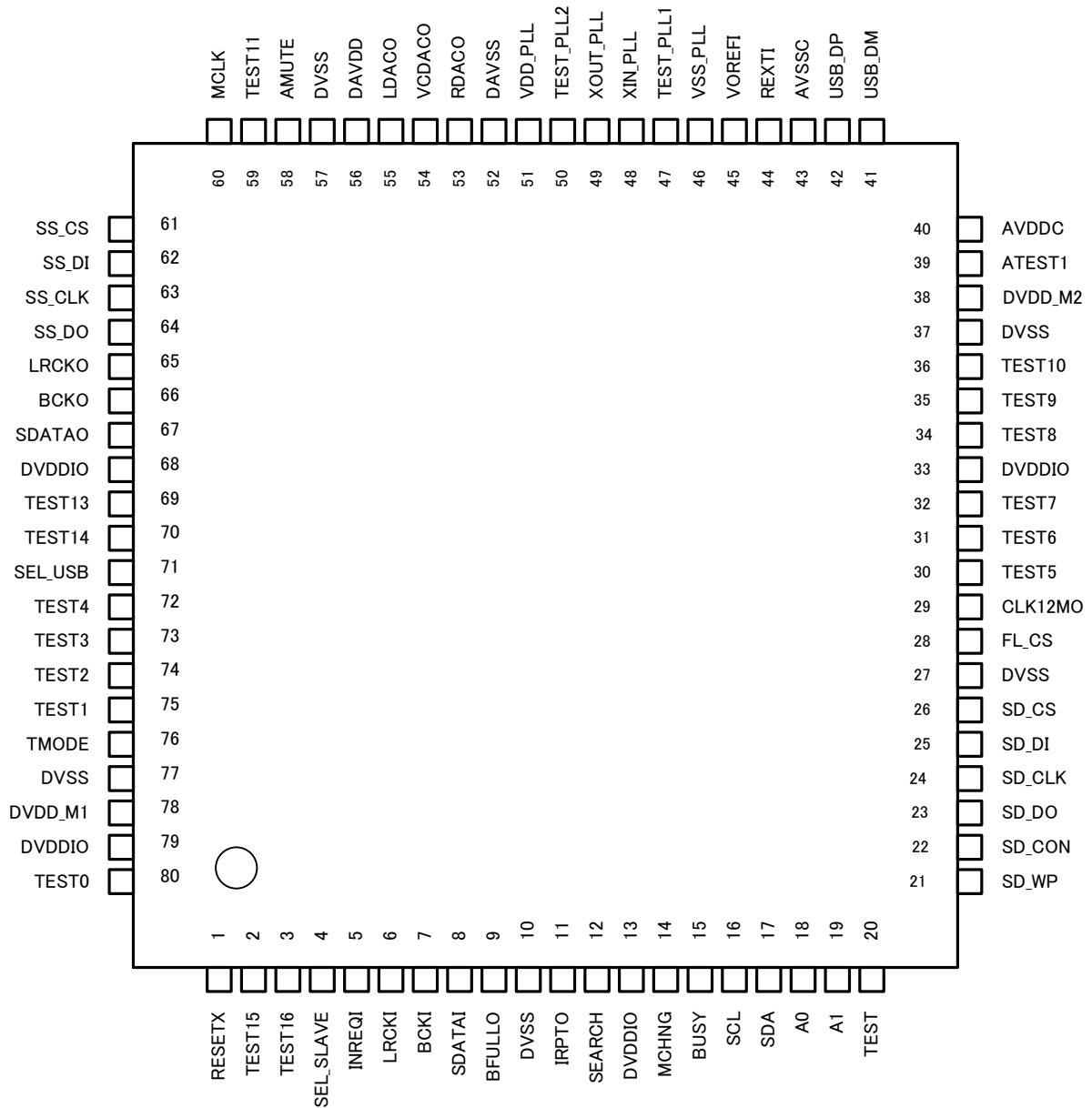*2 BU94705AKV and BU94702AKV only.

●**Arrangement of Terminals**

Figure 3. Arrangement of Terminals

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● **Description of Terminals**

No	Pin Name	IO Cir	IO	PU	Function
1	RESETX	A	I	PU*3	H: Release RESET, L: RESET
2	TEST15	I	O	*2	Test mode terminal. Pull it up at VDD1 power.
3	TEST16	I	I/O	*2	Test mode terminal. Pull it up at VDD1 power.
4	SEL_SLAVE	B	I	-	Test mode terminal. Connect it to GND.
5	INREQI	B	I	-	Input data valid terminal *5
6	LRCKI	B	I	-	Digital Audio channel clock input terminal
7	BCKI	B	I	-	Digital Audio bit clock input terminal
8	SDATAI	B	I	-	Digital Audio channel data input terminal
9	BFULLO	B	O	-	Input buffer full flag output terminal *5
10	DVSS	-	-	-	GND terminal
11	IRPTO	B	O	-	Connection interrupt output terminal *5
12	SEARCH	B	O	-	Search flag output terminal *5
13	DVDDIO	-	-	-	IO power (VDD1) terminal
14	MCHNG	B	O	-	File play end flag output terminal *5
15	BUSY	B	O	-	Command analysis BUSY output temrinal *5
16	SCL	I	I	*2	I^{2}C slave clock input terminal *5
17	SDA	I	I/O	*2	I^{2}C slave data I/O terminal *5
18	A0	B	I	-	I^{2}C slave address setting terminal
19	A1	B	I	-	I^{2}C slave address setting terminal
20	TEST	B	I	-	Test mode terminal. Pull it up at VDD1 power.
21	SD_WP	B	I	PU*3	SD card I/F WP detection terminal
22	SD_CON	B	I	PU*3	SD card I/F connection detection terminal
23	SD_DO	B	I	-	SD card I/F data input terminal
24	SD_CLK	B	O	-	SD card I/F clock output terminal
25	SD_DI	B	O	-	SD card I/F data output terminal
26	SD_CS	B	O	-	SD card I/F chip select output terminal
27	DVSS	-	-	-	GND terminal
28	FL_CS	B	O	-	Serial Flash ROM chip select output terminal
29	CLK12MO	B	O	-	12MHz CLK Output.
30	TEST5	B	O	-	Test mode terminal. Use it as OPEN.
31	TEST6	H	I	-	Test mode terminal. Pull it up at VDD1 power.
32	TEST7	H	I	-	Test mode terminal. Pull it up at VDD1 power.
33	DVDDIO	-	-	-	IO power (VDD1) terminal
34	TEST8	H	I	-	Test mode terminal. Pull it up at VDD1 power.
35	TEST9	H	I	-	Test mode terminal. Pull it up at VDD1 power.
36	TEST10	B	O	-	Test mode terminal. (IPL ERROR status). Use it as OPEN.
37	DVSS	-	-	-	GND terminal.
38	DVDD_M2	-	-	-	CORE power (VDD2) monitor terminal Short-circuit to DVDD_M1. Connect bypass capacitor.
39	ATEST1	-	O	-	USB test terminal (OPEN).
40	AVDDC	-	-	-	USB power (VDD1) terminal.
41	USB_DM	C	I/O	-	USB D-I/O terminal.
42	USB_DP	C	I/O	-	USB D+ I/O terminal.
43	AVSSC	-	-	-	USB GND terminal.
44	REXTI	D	O	-	USB reference voltage output terminal Connect to AVSSC terminal using USB bias resistor (12kΩ). Please arrange the resistance of 12kΩ near PIN. The wiring for the PIN side must not intersect with other signal lines.

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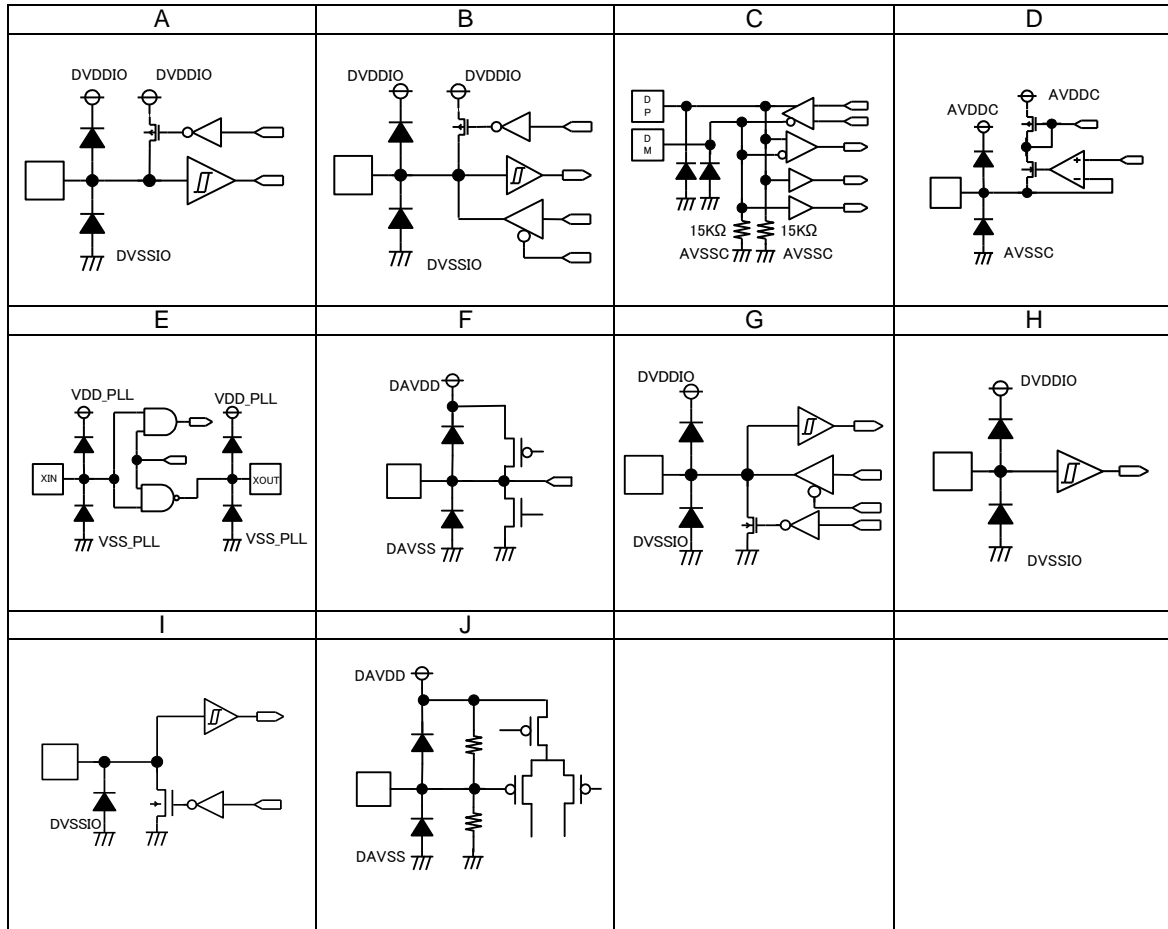| 45	VOREFI	-	O	-	USB test terminal (OPEN).
46	VSS_PLL	-	-	-	PLL GND terminal.
47	TEST_PLL1	-	I	-	PLL test terminal. (OPEN)
48	XIN_PLL	E	I	-	X'tal (16.9344MHz) connection input terminal. *4
49	XOUT_PLL	E	O	-	X'tal (16.9344MHz) connection output terminal. *4
50	TEST_PLL2	-	I	-	PLL test terminal. Pull it up at VDD1 power.
51	VDD_PLL	-	-	-	PLL power (VDD1) terminal.
52	DAVSS	-	-	-	Audio DAC GND terminal
53	RDACO	F	O	-	Audio DAC Rch line output terminal
54	VCDACO	J	O	-	Audio DAC reference voltage output terminal
55	LDACO	F	O	-	Audio DAC Lch line output terminal
56	DAVDD	-	-	-	Audio DAC power (VDD1) terminal
57	DVSS	-	-	-	GND terminal
58	AMUTE	G	O	-	Audio mute output (H: Mute OFF, L: Mute ON) terminal
59	TEST11	B	O	-	Test mode terminal. Use it as OPEN.
60	TEST12	B	O	-	Master Clock output(16.9344MHz)
61	SS_CS	B	I	-	SIO Slave CS input terminal
62	SS_DI	B	I	-	SIO Slave DATA input terminal
63	SS_CLK	B	I	-	SIO Slave clock input terminal
64	SS_DO	B	O	-	SIO Slave DATA output terminal
65	LRCKO	B	O	-	Digital Audio channel clock output / SPDIF output
66	BCKO	B	O	-	Digital Audio bit clock output
67	SDARAO	B	O	-	Digital Audio data output
68	DVDDIO	-	-	-	I/O power (VDD1) terminal
69	TEST13	B	O	-	Test mode terminal Use it as OPEN.
70	TEST14	B	O	-	Test mode terminal Use it as OPEN.
71	SEL_USB	B	I	PU *1*3	Preference detection device select(H: USB, L: SD)
72	TEST4	H	I	-	Test mode terminal. Pull it up at VDD1 power.
73	TEST3	H	I	-	Test mode terminal (IPL WRITE MODE1). Pull it up at VDD1 power.
74	TEST2	H	I	-	Test mode terminal (IPL WRITE MODE2). Pull it up at VDD1 power.
75	TEST1	H	I	-	Test mode terminal. Pull it up at VDD1 power.
76	TMODE	H	I	-	Test mode terminal. Connect it to GND.
77	DVSS	-	-	-	GND terminal
78	DVDD_M1	-	-	-	CORE power (VDD2) monitor terminal. Connect it to bypass capacitor.
79	DVDDIO	-	-	-	IO power (VDD1) terminal
80	TEST0	-	I	-	Test mode terminal. Connect it to GND.

*1 Pull-Up turns OFF when L is input.
*2 An external pull-up resistor is required because of Open Drain IO.
*3 please input L level directly without resistance when you input L to the terminal with Pull-Up (about 33 kΩ).
*4 Please confirm the optimal oscillation circuit parameters applicable to your systems or products with the oscillator manufacturer in advance.
*5 Please connect with the microcomputer terminal.

●**Terminal equivalent circuit diagram**

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●**Description of each block's movement   -part1**

1. USB host interface
· Builds in the USB Full speed (12Mbps) HOST control function.
· Supports the USB mass storage class.
· Converts the protocol from I^{2}C to USB (HID) or vice versa during communications with the master microcomputer. *1
· Builds in isochronous transmission functions up to 192byte/Frame. *1
· Builds in the interrupt IN transfer function. *1
· Doesn't support external HUB.
  *1 These functions are available for a device having two or more configurations.
     BU94607AKV and BU94705AKV only.

2. SD card interface
· Supports the SPI mode.
· Supports SDHC memory cards.
· Supports MMC, mini-SD and micro-SD cards.
· Does not support CPRM.

3. CD input interface
· Supports digital audio 3-line inputs (I2S, EIAJ format). *2
· Supports CD-ROM 3-line inputs (I2S, EIAJ format).
· Supports the data connection function by comparison with data at the last time. *2
· Encodes the input data in the MP3 or WAV format and writes encoded data to a USB or SD memory. *2
· Builds in the CD-ROM decoder function.

  *2 BU94702AKV and BU94705AKV only.
  Real time recording can be realized only by the recording memory (USB memory /SD memory card) that a writing
  response speed *) **) is fast. Even the recording memory that a response speed is early when it is written in in a
  short time, a response sometimes becomes slow by long writing. Use the recording memory that it was fully verified
  by the product specifications.

  *) It is a response speed toward an order for mass storage writing in the USB "Full Speed" standard connection of the
     USB memory. It doesn't influence a response speed in "High Speed" or "Ultra High Speed" and an average
     transfer speed.

  **) It is a response speed toward an order for mass storage writing in the SPI mode connection of the SD memory
      card. It doesn't influence a response speed in the SD mode connection and a Class speed.

4. I^{2}C command interface (Slave I/F)
· Communicates with the master microcomputer using the I^{2}C interface format.
· Operates as I^{2}C slave I/F.
· Supports the standard mode (100kbps) and the fast mode (400kbps).
· Supports 7-bit addresses.
· Can select four types of slave addresses.

5. Serial interface (Slave I/F)
· Supports the SPI mode.
· Operates as SPI slave I/F.
· Supports 8-, 16 and 32 bit/transfer data. An input clock supports to Max. =2MHz.
· Supports to download data such as images within the memory to the microcomputer.

6. Audio output
· Supports audio line outputs from built-in 1bit-DAC.
· Builds in the digital soft mute function. *
· Supports digital audio outputs of the I2S format, the EIAJ format and those and the digital audio interface (SPDIF).
· Builds in sound effects including POPS, JAZZ, and ROCK, CLASSIC, R&B and BassBoost. *
  *This is available for audio line outputs only.

7. Sample rate converter
· Converts all support sample rates to 44.1 kHz based on the polyphase calculation.

8. System controller
· Control all operations including interface control to the master microcomputer, USB device access, SD card access,
  FAT analysis, sort function, decoding, encoding and audio output.

● **Description of each block's movement   -part2**
9. FAT analysis
- Supports FAT32, FAT16 and FAT12 file system.
- Supports VFAT (long file name).
- Supports multi-partition up to 1 partition.
- Supports multi-drive up to 1 drive.
- Supports playable folder hierarchies up to 16 hierarchies whose full path including the file name is within 260 characters.
- Supports playable file extension of *.wav for WAV files.
- Supports playable file extensions of *.m4a, *.3gp and *.mp4 for AAC files.
- Supports playable file extensions of *.asf and *.wma for WMA files.
- Supports playable file extensions of *.mp3, *.mp2 and *.mp1 for MP3 files. For *.mp2 and *.mp1, the function allows you to select whether to play. Does not extinguish between upper case letters and lower case letters of file extensions.
- Up to 100 folders and 100 files can be sorted and played in the order of UNICODE when sorting functional effective.
- Can obtain 5 file names ahead from current music file.
- Can obtain a folder name or file name within 128 bytes.
- Supports 512, 1024, 2048 and 4096 bytes per sector.
- Playable file size up to 2G-1 byte. A file over 2Gbyte is recognized as a playable file, too. But, it is for 2Gbyte -1byte that it can play.
- Supports the device size up to FAT specification (2T byte).

10. Control from master microcomputer (little endian order)
- Can control from the master microcomputer using the I^{2}C interface.   (This function is available in MODE2 only.)
- Controllable using commands of play, pause, stop, tune skip, tune forward, folder move, device change, volume setting, repeat change, random play, digital audio output setting, sound effect setting and direct tune selection and etc.
- Can read information on internal status during play or stop, folder number, file number within the folder, play time, total number of folders, total number of files, name of folder being played, name of file being played and TAG (title, artist, album, genre), and etc.

11. MP3 encoder (*3 BU94702AKV and BU94705AKV only.)
- Supports MP3 format encode (MPEG1 Layer3).
- Decoding operation cannot be performed during encoding operation.
- Supports sample rate of 32 k, 44.1 k and 48 kHz.
- Can select encoding bit rate from 32 kbps, 64 kbps, 128 kbps, 192 kbps, 256 kbps and 320 kbps (CBR).
- Supports the writing of the encoded file to USB or SD card.

12. MP3 decoder
- Supports MPEG audio 1, 2 and 2.5.
- Supports Layer1, 2 and 3.
- Supports sample rate of 8 k, 16 k, 32 k, 11.025 k, 22.05 k, 44.1 k, 12 k, 24 k and 48 kHz.
- Supports bit rate of 8 to 320 kbps and VBR (Variable Bit Rate). *Excluding the free format
- Supports ID3TAG V1.0, V1. 1, V2.2, V2.3 and V2.4. (Up to 128 bytes can obtain for album, artist, title and genre, respectively.)

13. WMA decoder
- Supports Windows Media Audio 9 standard.
- Not supports DRM files.
- Supports sample rate of 8 k, 16 k, 32 k, 11.025 k, 22.05 k, 44.1 k and 48 kHz.
- Supports bit rate of 5 to 384 kbps and VBR (Variable Bit Rate).
- Supports WMA-TAG. (Up to 128 bytes can obtain for album, artist, title and genre, respectively.)

● **Description of each block's movement**　　　　**-part2**

14. AAC decoder
- Supports MPEG4 AAC-LC (Audio stream).
- Based on 3GPP TS 26.244 and iTunes.
- Supports File Type of m4a, mp42 and 3gpX. (X stands for any numeric value.)
- Not supports DRM files. Not supports CD-ROM playing.
- Supports sample rate of 8 k, 16 k, 32 k, 11.025 k, 22.05 k, 44.1 k, 12 k, 24 k and 48 kHz.
- Supports bit rate of 8 to 320kbps and VBR (Variable Bit Rate).
- Supports AACTAG (iTunes Meta-data and 3GP Meta-data).
  (Up to 128 bytes can obtain for album, artist, title and genre, respectively.)
  *For files other than those encoded by iTunes, sound interruption may occur when skipping or forwarding to the next tune if streams such as gaps and video data are contained in the file.

15. WAV play
- Supports WAV format.
- Supports sample rate of 8 k, 16 k, 32 k, 11.025 k, 22.05 k, 44.1 k, 12 k, 24 k and 48 kHz.
- Supports 16-bit PCM data.
- Not supports CD-ROM playing.
- Supports RIFF TAG.
  (Up to 128 bytes can obtain for album, artist, title and genre, respectively.)

16. Browsing and direct tune selection
- Can analyzes and read other file name in memory while playing the current music.
- Up to 64 bytes can obtain for file name, folder name respectively.
- Supports direct music selection using the analysis data.

17. Repeat and random play
- Supports repeat within the memory, repeat within folder and repeat with single tune.
- Supports random play within the area of ±128 files.
- Can select auto-play of next music or stop playing at the end of current music playing.

18. Play according to play list
- Supports play in the order given in the specified play list within the specified folder.
- Supports extensions of *.m3u and *.pls.
- Supports play lists described in full path of ASCII or SHIFT-JIS.

19. CD-ROM Decoder
- Supports CD-ROM Mode1, Mode2 form1, and Mode2 form2 format.
- Supports CD-ROM ECC and CD-ROM EDC function.
- Supports ISO9660 level 1 and level 2 file systems.
- Supports Remeo and Joliet extension.
- Supports playable folder hierarchies up to 8 hierarchies.
- Supports playable file extension of *. asf, wma for WMA files, mp3, mp2, mp1 for MP3 files.
- Output the interruption signal and status of the required LBN for seeking operation.
- Build in the input data buffer of about 100 kByte. (include file system analysis data)
- Up to 48bytes can obtain for file name, folder name respectively.

20. Read/Write from/to files within memory
- Can read the data from specified file stored in the specified folder within the memory.
- Can write the data to specified file in the specified folder within the memory.

21. IPL (Initial Program Download)
- Communicates with a serial FLASH ROM using a SD interface (SPI master I/F).
- Downloads the program data to the internal Program RAM at power ON.
- Serial FLASH ROM supports to 8 bit-Command, 24 bit-ADDRESS, and clock MIN=15MHz by minimum size 2Mbit.
- In the IPL write mode, writes the specified data in USB or SD memory to a serial FLASH ROM.

●**Absolute maximum ratings (Ta = 25℃)**

Parameter	Symbol	Limits	Unit	Comment
Supply voltage(Analog, I/O)	VDD1MAX	-0.3 to 4.5	V	DVDDIO, VDD_PLL, DAVDD, AVDDC
Input voltage	VIN	-0.3 to VDD1 + 0.3	V	
Storage temperature range	TSTG	-55 to 125	°C	
Operating temperature range	TOPR	-40 to 85	°C	
Power dissipation *1	PD1	900	mW	

*1:In the case of use at Ta=25℃ or more, 9mW should be reduced per 1℃.
Radiation resistance design is not arranged.

●**Operating conditions   (Ta = 25℃)**

Parameter	Symbol	Limits	Unit	Comment
Supply voltage(Analog, I/O)	VDD1	3.0 to 3.6	V	DVDDIO, VDD_PLL, DAVDD, AVDDC

●**Electrical characteristics**
(Unless specified, Ta=25℃, VDD1=3.3V, DVSS=AVSSC=VSS_PLL=DAVSS=0V, XIN_PLL=16.9344MHz)

Parameter	Symbol	Limits			Unit	Condition
		MIN.	TYP.	MAX.		
			\<Total >			
Circuit current (VDD1 USB1)	IDD1USB1	-	51.0	75.0	mA	*1 When USB memory is played.
Circuit current (VDD1 SD1)	IDD1SD1	-	26.0	45.0	mA	*1 When SD card is played.
			\<Digital block>			
H-Level input voltage	VIH	VDD1*0.7	—	VDD1	V	*2
L-Level input voltage	VIL	DVSS	—	VDD1*0.3	V	*2
H-Level output voltage1	VOH1	VDD1-0.4	—	VDD1	V	IOH=-1.6mA, *3
L-Level output voltage1	VOL1	0	—	0.4	V	IOL=1.6mA. *3
L-Level output voltage2	VOL2	0	—	0.4	V	IOL=3.6mA, *4
H-Level output voltage3	VOH3	VDD1-0.4	—	VDD1	V	IOH=-0.6mA, *5
L-Level output voltage3	VOL3	0	—	0.4	V	IOL=0.6mA, *5
H-Level output voltage4	VOH4	VDD1-1.0	—	VDD1	V	IOH=-1.6mA, *6
L-Level output voltage4	VOL4	0	—	1.0	V	IOL=1.6mA, *6
			\<USB-HOST >			
H-Level input voltage	VIHUSB	VDD1*0.6	—	VDD1	V	*7
L-Level input voltage	VILUSB	AVSSC	—	VDD1*0.3	V	*7
Output impedance(H)	ZOH	22.0	45.0	60.0	Ω	*7
Output impedance(L)	ZOL	22.0	45.0	60.0	Ω	*7
H-Level output voltage	VOHUSB	VDD1-0.5	—	VDD1	V	*7
L-Level output voltage	VOLUSB	0	—	0.3	V	*7
Rise/Fall time	Tr/Tf	—	11	—	ns	*7, Output capacity 50pF
Voltage of crossing point	VCRS	—	VDD1/2	—	V	*7, Output capacity 50pF
Range of differential input	VDIFF	0.8	—	2.5	V	*7
Differential input sensitivity	VSENS	0.2	—	—	V	*7
Pull-down resistance	RPD	14.25	20.0	24.8	kΩ	*7
			\<Audio DAC>			
Distortion rate	THD	—	0.005	0.05	%	1kHz, 0dB, sine, *8
Dynamic range	DR	—	90	—	dB	1kHz, -60dB, sine, *8
S/N ratio	S/N	66	96	—	dB	1kHz, 0dB, A-weighted, *8
Max output level	VSMAX	0.60	0.75	—	Vrms	1kHz, 0dB, sine, *8

*1 3.3V system I/O, Analog Power supply (VDD1), 1kHz, 0dB, sine-wave playing
*2 1, 3, 4-9, 14-23, 29, 31-32, 34-35, 61-63, 71-76 pin
*3 9, 11-12, 14-15, 18-20, 30, 36, 58-60, 61-67, 69-70 pin
*4 2, 3, 17 pin
*5 24-26, 28, 29 pin
*6 49 pin
*7 41, 42 pin
*8 53, 55 pin output no-load

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●**Application Information**

1. Clock and Reset

Clock

Clock name	I/O	Function	Function
XIN_PLL	I	X'tal (16.9344MHz) connection input terminal	
XOUT_PLL	O	X'tal (16.9344MHz) connection terminal	

Reset

Signal name	I/O	Function	Remarks
RESETX	I	System reset input terminal	

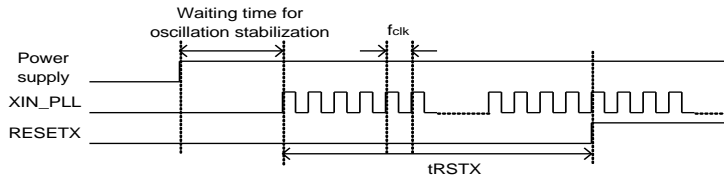Please release the reset signal continue L input for more than 100 us after clock input from the oscillation I/O terminal becomes stable. (See Figure 4)

Figure 4. Reset Timing

Table 1. Timing

Item	Symbol	Rating			Unit	Remarks
		min	typ	max		
Clock frequency	f_{CLK}	16.9302	16.9344	16.9386	MHz	
Reset L interval	t_{RSTX}	100	-	-	us	

2. USB I/F

USB I/O interface

Signal name	I/O	Function	Remarks
USB_DP	I/O	USB D+ I/O terminal	
USB_DM	I/O	USB D- I/O terminal	
REXTI	O	USB bias resistor connection terminal	Connect a resistor of 12 kΩ±1% to GND.

This interface communicates with the USB device using USB_DP and USB_DM differential signals.
REXTI terminal is used to connect to the bias resistor in the USB-PHY block.
Builds in the USB Full speed (12Mbps) HOST control function.
Supports the USB mass storage class.
Doesn't support external HUB.

3. SD I/F

SD memory card SPI interface

Signal name	I/O	Function	Remarks
FL_CS	O	Serial flash ROM chip select	
SD_CS	O	SD chip select	
SD_CLK	O	SPI clock	
SD_DI	O	SPI data input	
SD_DO	I	SPI data output	
SD_CON	I	SD card connect detection terminal	H: Do not detect SD card connect, L: Detect SD card connect
SD_WP	I	SD card write-protect detection terminal	H: SD write-protect valid, L: SD write-protect invalid

This interface connects to the SD memory card slot to communicate with the SD memory device.
Supports the SPI mode.
Supports SD, SDHC memory cards and MMC, mini-SD and micro-SD cards.
Does not support CPRM.
Since the SD memory card slot needs to detect the insertion status of the SD memory device and the write-protect status, be sure to use the slot having the SD memory card insertion status detection terminal and the WP terminal and connect it to the terminals.   The SD_CON terminal is pulled up within the device and detects "SD card connect" when L is input. The SD_WP terminal is pulled up within the device and detects "SD card no-write-protect" when L is input.
SD I/F is also used as an external serial flash ROM I/F.

3.1 Timing

Table 2. Timing
(Unless specified, Ta=25℃, VDD1=3.3V, Load=20pF, 10kΩ)

Item	Symbol	Rating			Unit	Remarks
		min	typ	max		
SD_CS Setup time	Tcss	-	5	-	us	
SD_CS Hold time	Tcsh	-	15	-	us	
SD_CLK Clock Frequency	Tclk	-	13.5	-	MHz	
SD_DI Output delay	Tod	-20	-	20	ns	
SD_DO Data in Setup time	Tds	18	-	-	ns	
SD_DO Data in Hold time	Tdh	5	-	-	ns	
Output High Voltage	Voh	0.625*VDD1	-	-	V	
Output Low Voltage	Vol	-	-	0.25*VDD1	V	
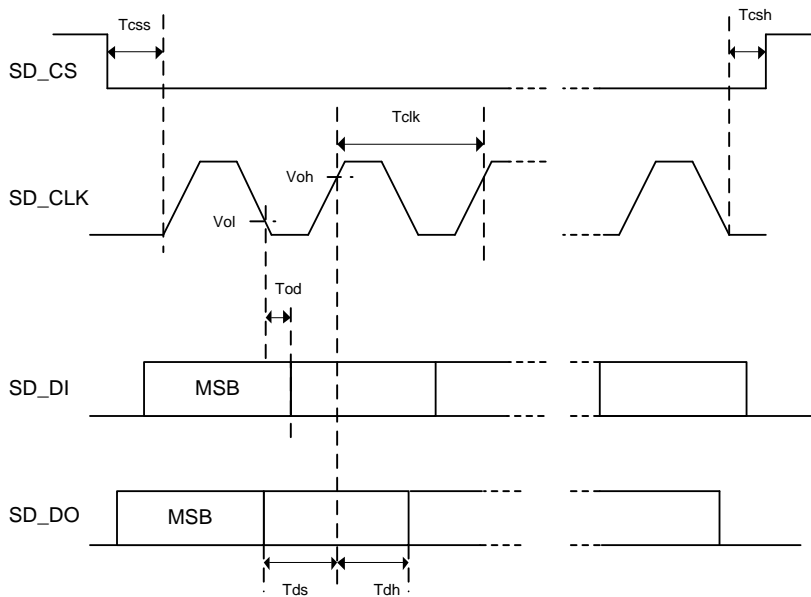
Figure 5. SPI I/F Timing

4. Audio line output
Audio line output

Signal name	I/O	Function	Function
LDACO	O	Lch audio line output	
RDACO	O	Rch audio line output	

Supports Audio line outputs from built-in 1bit-DAC.
Builds in the digital soft mute function.
Builds in sound effects including POPS, JAZZ, ROCK, CLASSIC, R&B and BassBoost.
It turns ON when line output is selected by a command.
The data of the sample rate 48 kHz and 32 kHz is converted into 44.1 kHz and output.

4.1 Volume
   Figure 6 shows the relationship between audio outputs and volume steps.
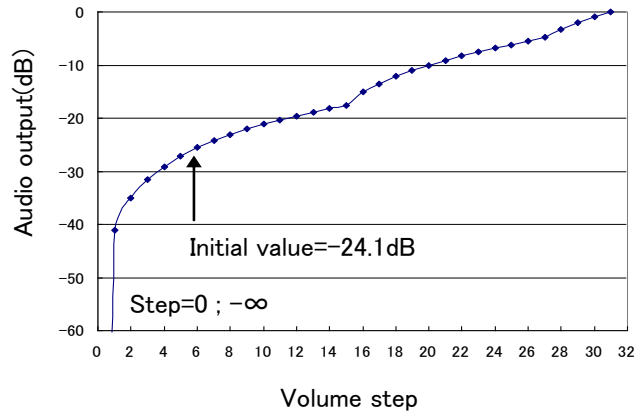   The initial value is step=6=−24.1dB at power ON.

Figure 6. Volume Step Function

4.2 Equalizers
   You can select audio line output from 5 types of equalizers and 2 types of bus boosts, using commands. You can use a combination of an equalizer and bus boost 1.
   Even when line output is not selected, the equalizer setting is valid.   However, for digital output, the equalizer cannot change the sound quality.
   Clipping may occur by the combination of volume and equalizer setting.
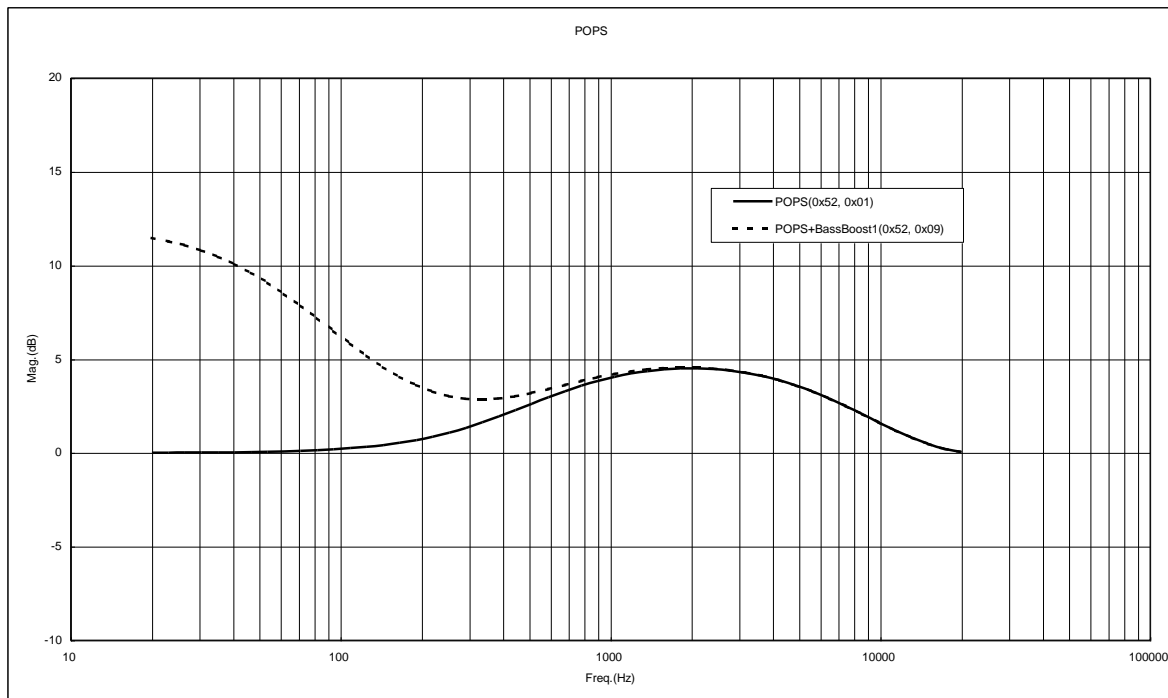   Figures 7 to 12 show frequency characteristics of each filter.

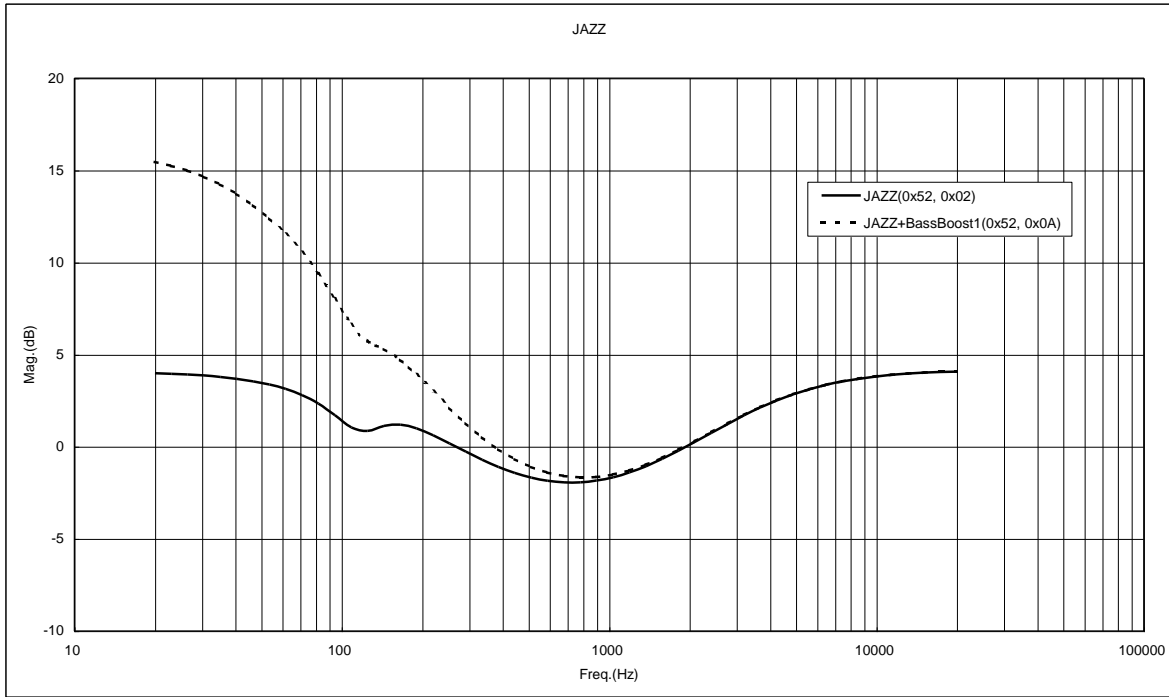Figure 7. POPS Frequency Characteristics

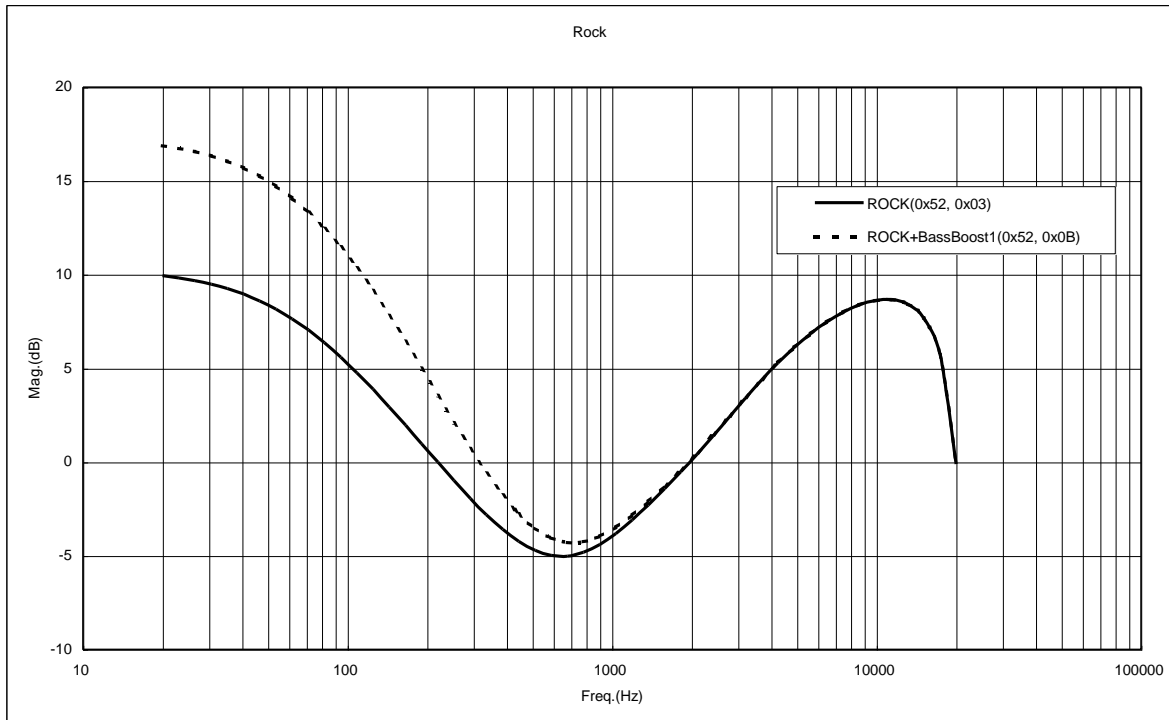Figure 8. JAZZ Frequency Characteristics

Figure 9. ROCK Frequency Characteristics

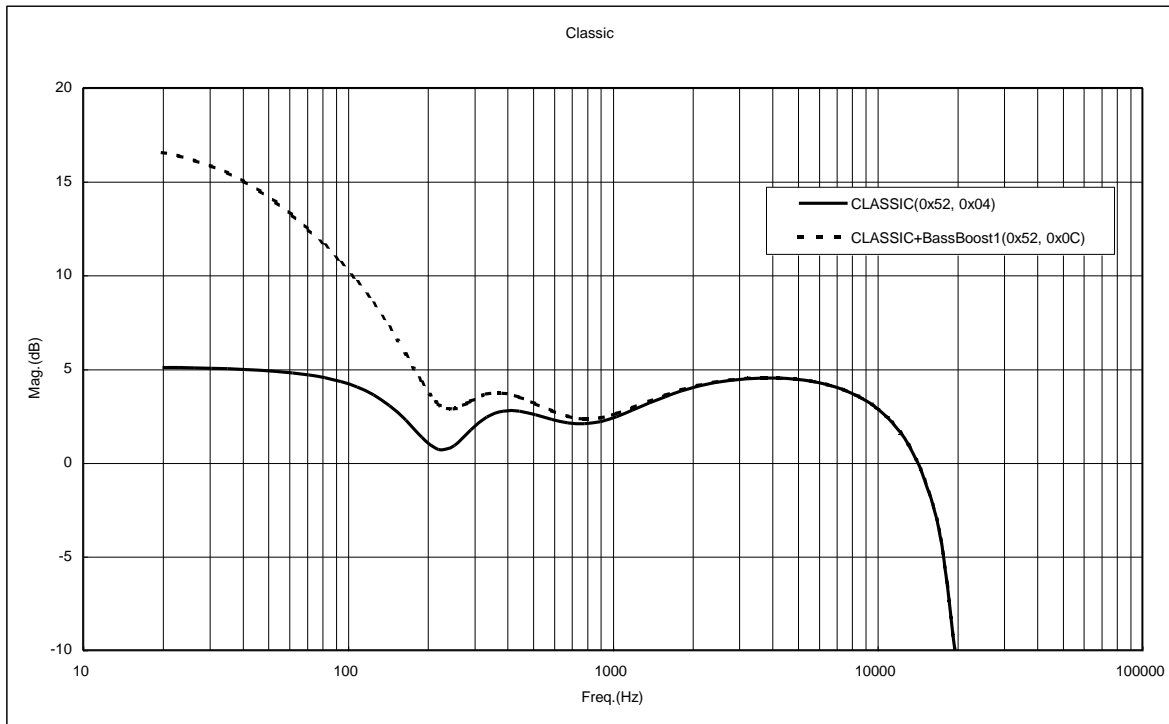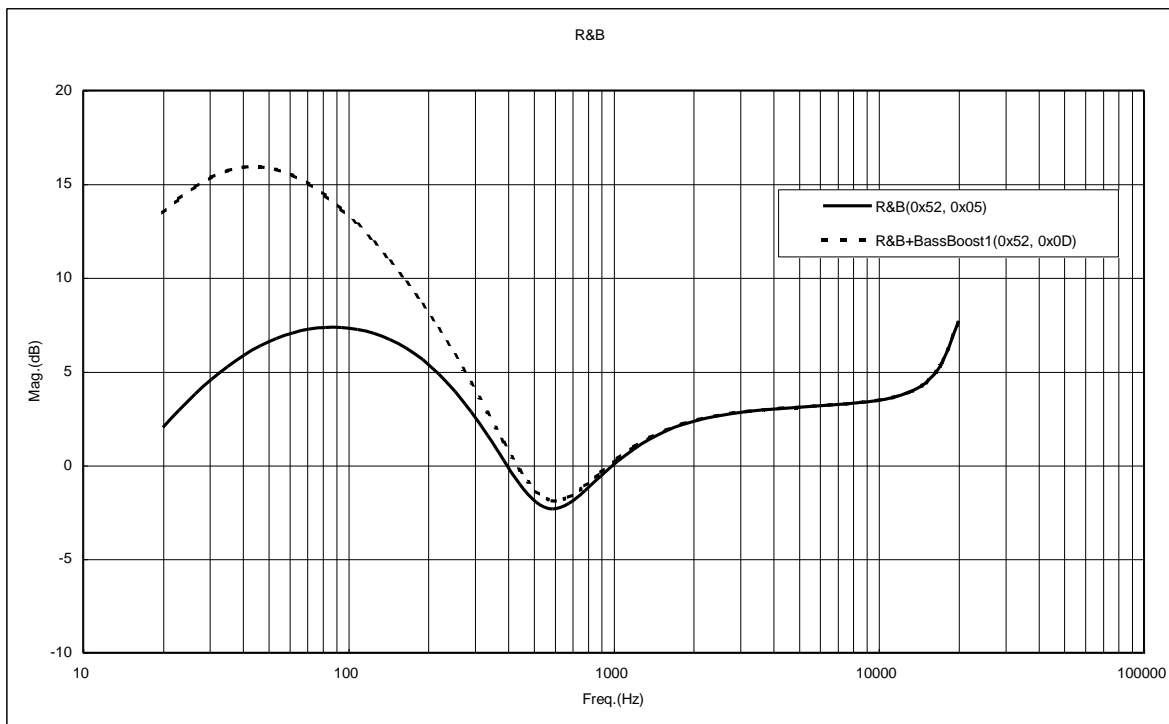Figure 10. CLASSIC Frequency Characteristics

Figure 11. R&B

BassBoost

Figure 12. Bass Boost

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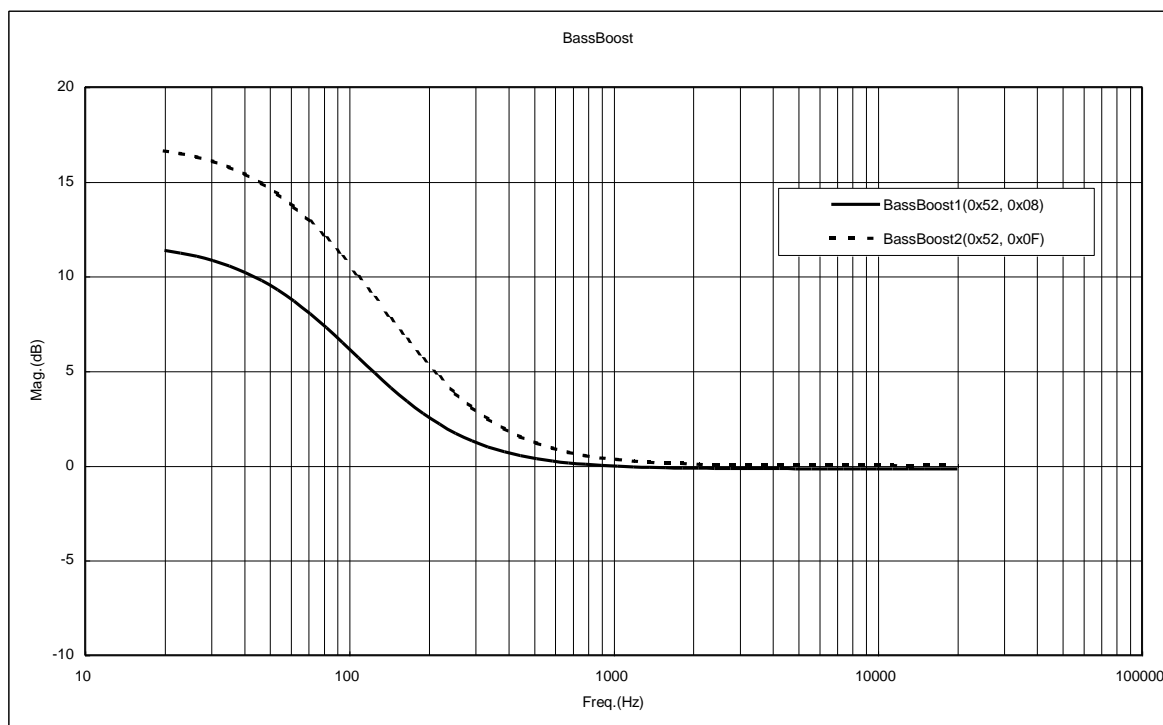
5. MUTE control output
Audio MUTE

Signal name	I/O	Function	Remarks
AMUTE	O	Audio mute control terminal	H: At audio output , L: At mute

It outputs H at audio output and L at mute.
It is possible to use it as a flag to do the mute with the amplifier etc. of latter part at no sounds such as power supplies ON and FF and FB.
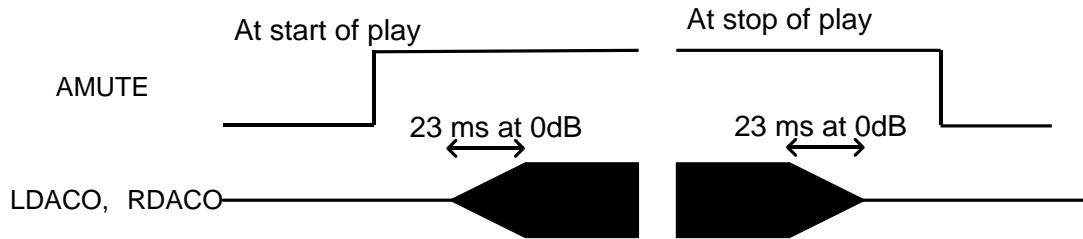Figure 13 shows the operation waveforms.

Figure 13. Waveform at Audio Mute

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6. Digital Audio output
Three-line serial Digital audio interface

Signal name	I/O	Function	Remarks
LRCKO	O	LR clock output (fs=44.1kHz)	
BCKO	O	Bit clock output	
DATAO	O	Data output	

This is a Digital audio output interface terminal. It becomes enabled by using the appropriate command.
The output format can be selected from the EIAJ format or I²S format of 32fs, 48fs or 64fs.
The data of the sample rate 48 kHz and 32 kHz is converted into 44.1 kHz and output.

6.1 Output Format
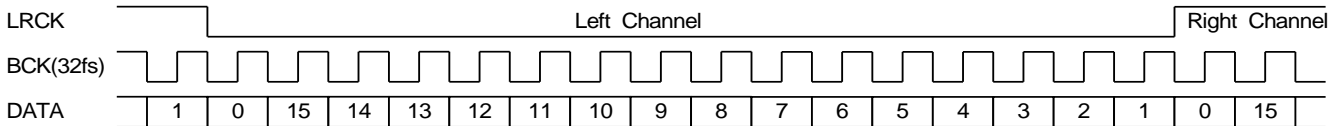Figures 14, 15, 16, 17, 18 and 19 show the output formats.

Figure 14. I²S Output Timing (32fs)
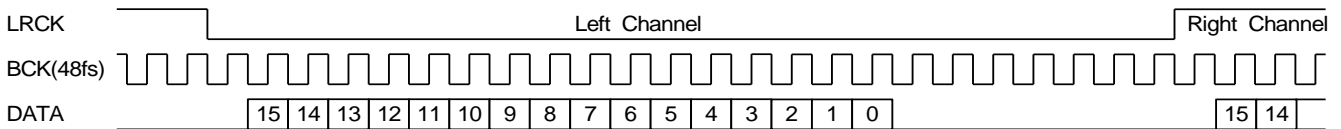
Figure 15. I²S Output Timing (48fs)
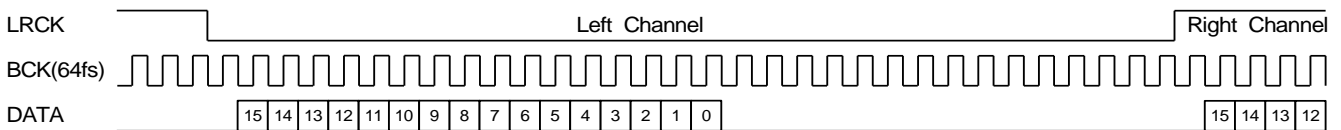
Figure 16. I²S Output Timing (64fs)
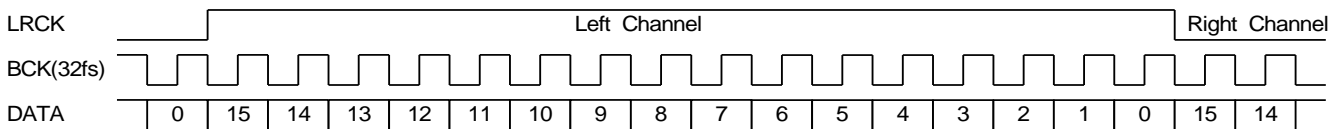
Figure 17. EIAJ Output Timing (32fs)
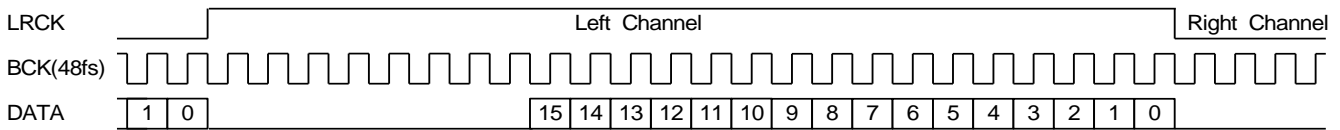
Figure 18. EIAJ Output Timing (48fs)
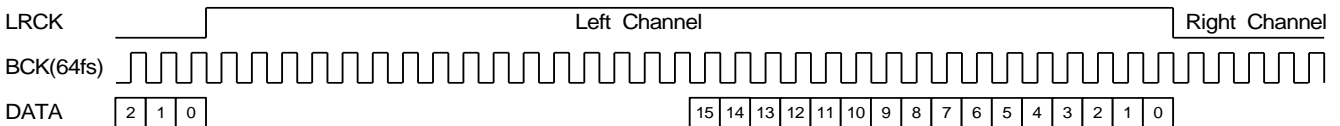
Figure 19. EIAJ Output Timing (64fs)

6.2 Timing

Table 3. Timing
48fs I^{2}S format (Unless specified, Ta=25℃, VDD1=3.3V, Load=20pF)

Item	Symbol	Rating			Unit	Remarks
		min	typ	max		
BCK Clock Frequency	Tbck	-	472.4	-	ns	
BCK Low time	Tbck1	216	236	-	ns	
BCK High time	Tbck2	216	236	-	ns	
LRCK Clock Frequency	Tlrck	-	44.1	-	kHz	
LRCK Output delay	Tlrck1	-20	0	20	ns	
DATA Output delay	Tda1	-20	0	20	ns	
Output High Voltage	Toh	VDD1-0.4	-	-	V	
Output Low Voltage	Vol	-	-	0.4	V	
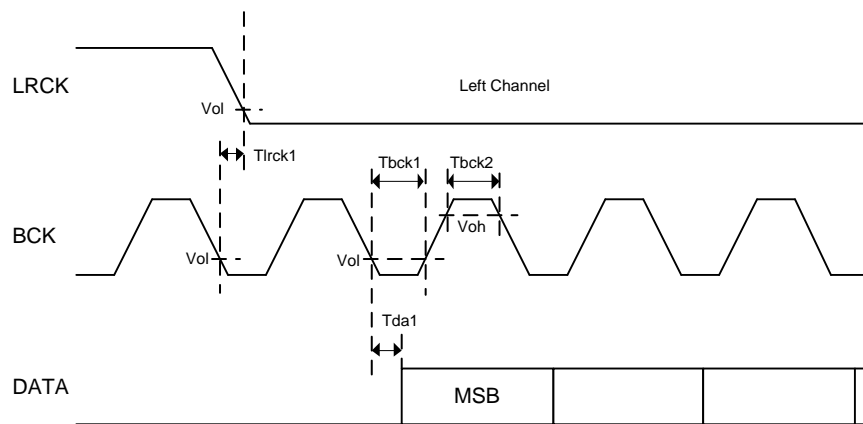
Figure 20. Output Timing

7. SPDIF output
SPDIF interface

Signal Name	I/O	Function	Remarks
SPDIF	O	SPDIF output	

SPDIF output become enabled by setting it using the appropriate command.
The data of the sample rate 48 kHz and 32 kHz is converted into 44.1 kHz and output.

7.1 Format
Figure 21. shows the SPDIF signal output format.
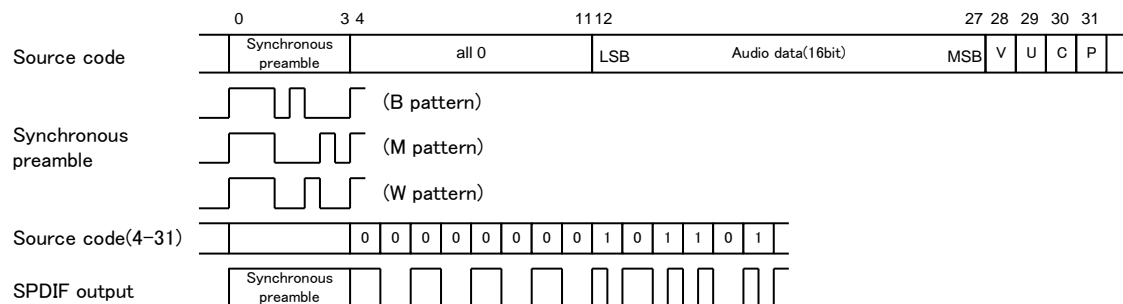
Figure 21. SPDIF Output Format

One sub frame of SPDIF consists of synchronous preambles, 16-bit audio data, V bit (validity flag), U bit (user data), C bit (channel status) and P bit (parity bit).
Output rate is fixed to 1X speed (44.1 kHz).
SPDIF outputs synchronous preambles (source code 0-3) as they are, and other elements (source code 4-31) as the biphase output.　While the operation stops, L output is enabled.
Synchronous preambles and C bit use 32 frames (≈4.4 ms) for one cycle.　The data formats are shown in Table 4 and Table 5 V bit is fixed to L. U bit uses 98 frames (≈13.3 ms) for one cycle.

Table 4. Synchronous Preamble Pattern

	L0	R0	L1	R1	L2	R2	L3	R3	L4	R4	L5	R5
0	B	W	M	W	M	W	M	W	M	W	M	W
1	M	W	M	W	M	W	M	W	M	W	M	W
:	:	:	:	:	:	:	:	:	:	:	:	:
31	M	W	M	W	M	W	M	W	M	W	M	W

Table 5. C Bit Format

	L0	R0	L1	R1	L2	R2	L3	R3	L4	R4	L5	R5
0	0		0		Copy		0		0		0	
1	0		0		1		0		0		0	
2	0		0		0		Lbit		0		0	
3	0		0		1	0	0	1	0		0	
4	0		0		0		0		0		0	
5	0		0		0		0		0		0	
:	:		:		:		:		:		:	
31	0		0		0		0		0		0	

Table 6. U Bit Format

	L0	R0	L1	R1	L2	R2	L3	R3	L4	R4	L5	R5
0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0
2	1	0	0	0	0	0	0	0	0	0	0	0
3	1	0	0	0	0	0	0	0	0	0	0	0
:	:	:	:	:	:	:	:	:	:	:	:	:
97	1	0	0	0	0	0	0	0	0	0	0	0

P bit is set to 1 if the number of "1" contained in source codes 4-30 is odd, and set to 0 if the number is even. Therefore, the number of source codes to be set to 1 for one data must be even, SPDIF ends with L output, and preamble output always starts in the same direction.

7.2 Timing

'

Table 7. Timing

(Unless specified, Ta=25℃, VDD1=3.3V, Load=20pF)

Item	Symbol	Rating			Unit	Remarks
		min	typ	max		
SPDIF Clock Frequency	Tck	-	2.822	-	MHz	
SPDIF Clock High time	Tck1	157	177	-	ns	
SPDIF Clock Low time	Tck2	157	177	-	ns	
Output High Voltage	Voh	VDD1-0.4	-	-	V	
Output Low Voltage	Vol	-	-	0.4	V	
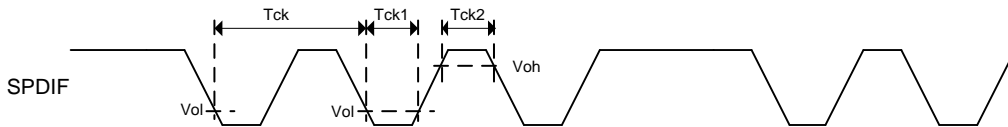
Figure 22. SPDIF Output Timing

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8. I²C command interface
Slave I²C serial interface

Signal name	I/O	Function	Remarks
SCL	I	I²C interface clock input	External pull-up resistor is required.
SDA	I/O	I²C interface data I/O	External pull-up resistor is required.
A0	I	Slave address selection terminal	Slave address [0] bit setting terminal
A1	I	Slave address selection terminal	Slave address [1] bit setting terminal

This is an I²C serial interface terminal to communicate with the microcomputer (master).
It supports slave I²C operations.
Supports the standard mode (100kbps) and the fast mode (400kbps).
Supports 7-bit addresses.

8.1 I²C protocol
When the I²C bus is in the IDLE state, SDA and SCL are set to H by the external Pull-up resistor.
To start communications, the master sets SDA to L while SCL set to H (Start condition). To finish communications, the master sets SDA to H while SCL set to H (Stop condition). During transfer, the master changes SDA only while SCL is L.
Figure 23 shows Start condition, Stop condition of I²C.
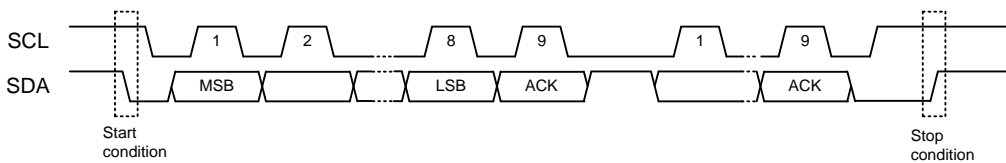
Figure 23. **I²C** Start and Stop Conditions

8.2 Slave address
I²C bus slave addresses support the 7-bit addressing mode. By inputting to terminals A0 and A1, the bus slave address can be selected as shown in Table 8. Figure 24 shows the slave address transfer format.
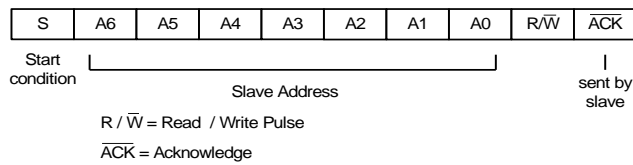
Figure 24. Slave Address Transfer Format

Table 8. Settable Slave Addresses

MSB A6	A5	A4	A3	A2	A1 terminal	LSB A0 terminal
1	0	0	0	0	0	0
1	0	0	0	0	0	1
1	0	0	0	0	1	0
1	0	0	0	0	1	1

8.3 Protocol to write from the master

When sending commands from the master using the I²C bus, be sure to conform to the transfer protocol shown in Figure 25 after BUSY PIN confirms the state of L, for details on each command, see Chapter 26.

| S | Slave Address | R/W | A | Data(8bit) | A | Data(8bit) | A | | Data(8bit) | A/Ā | P |

"0"(write)

⬚⬚ From Master to Slave   A = Acknowledge(SDA low)
▢ From Slave to Master   Ā = No Acknowledge(SDA high)
                             S = Start Condition
                             P = Stop condition

Figure 25. Command Send Protocol

8.4 Protocol to read to the master

When sending the received data from the slave to the master using the I²C bus, be sure to conform to the transfer protocol sh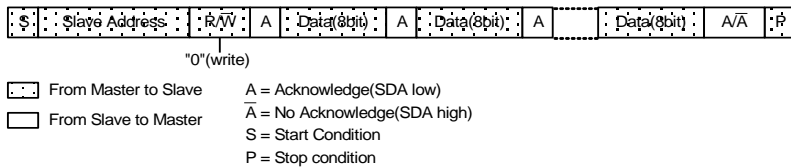own in Figure 26. First, transfer the status read command (step1). Then, input SCL clock of required bytes in step2 to read the status after BUSY PIN confirms the state of L.
When BUSY PIN is H, correct data is not transmitted.
The first byte of the transferred data (step2) outputs the status shown in Table 9. Data is output from the second byte.
Figure 27 shows the relationship between the transferred data and BUSY.
* For details on BUSY, see Chapter 9.

Table 9. BUSY Byte Structure

bit	STATUS
7	0
6	0
5	0
4	PRECOM
3	IRPTO
2	SEARCH
1	MCHNG
0	BUSY

Step1

| S | Slave Address | R/W | A | Data(8bit) | A | | Data(8bit) | A/Ā | P |

"0"(write)

Step2

| S | Slave Address | R/W | A | BUSY(8bit) | A | Data(8bit) | A | | Data(8bit) | Ā | P |

"1"(read)

⬚⬚ From Master to Slave   A = Acknowledge(SDA low)
▢ From Slave to Master   Ā = No Acknowledge(SDA high)
                             S = Start Condition
                             P = Stop condition

Figure 26. Status Reception Protocol

I2C | Step1 command | | S | Slave Address | R | A | 0x00 | Ā | Data(8bit) | Ā | | Data(8bit) | Ā | P |

BUSY   BUSY byte for Status
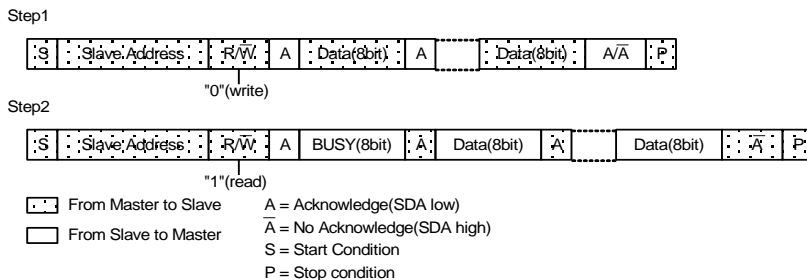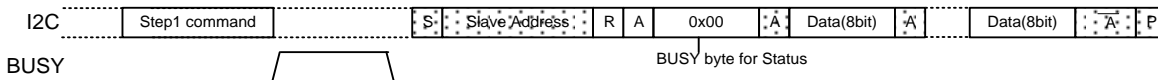
Figure 27. Relationship between Transferred Data and BUSY

8.5 I²C Bus line timing

Table 10. Timing

SDA and SCL bus-line characteristic (Unless specified, Ta=25℃, VDD1=3.3V)

Item	Symbol	Rating			Unit	Remarks
		min	typ	max		
SDA, SCL　H input voltage	VIH	VDD1*0.7	-	VDD1	V	
SDA, SCL　L input voltage	VIL	DVSS	-	VDD1*0.3	V	
SDA　H output voltage	VOH	VDD1-0.4	-	VDD1	V	
SDA　L output voltage	VOL	0	-	0.4	V	
SCL clock frequency	fSCL	0	-	400	kHz	
Bus-free-time between "Stop" condition and "Start" condition	tBUF	1.3	-	-	us	
Hold time for "Start" condition After this, the first clock pulse is generated.	tHD;DAT	0.6	-	-	us	
LOW status hold-time of SCL clock	tLOW	1.3	-	-	us	
HIGH status hold-time of SCL clock	tHIGH	0.6	-	-	us	
Data-hold-time	tHD;DAT	0*	-	-	us	
Date-setup-time	tSU;DAT	100	-	-	ns	
Rising time of SDA and SCL signal	tR	20+0.1*Cb	-	300	ns	
Fall time of SDA and SCL signal	tF	20+0.1*Cb	-	300	ns	
Setup time of "Stop" condition	tSU;STO	0.6	-	-	us	
Capacitive load of each bus-line	Cb	—	-	400	pF	

The above-mentioned numerical values are all the values corresponding to $V_{IH\,min}$ and $V_{IL\,max}$ level.

*To exceed an undefined area on falling edged of SCL, transmission device should internally offer the hold-time of 300ns or more for SDA signal ($V_{IH\,min}$ of SCL signal).

Because the "Repeated Start" condition to send "Start" condition without sending "Stop" condition doesn't correspond, after sending "Start" condition, always send "Stop" condition.

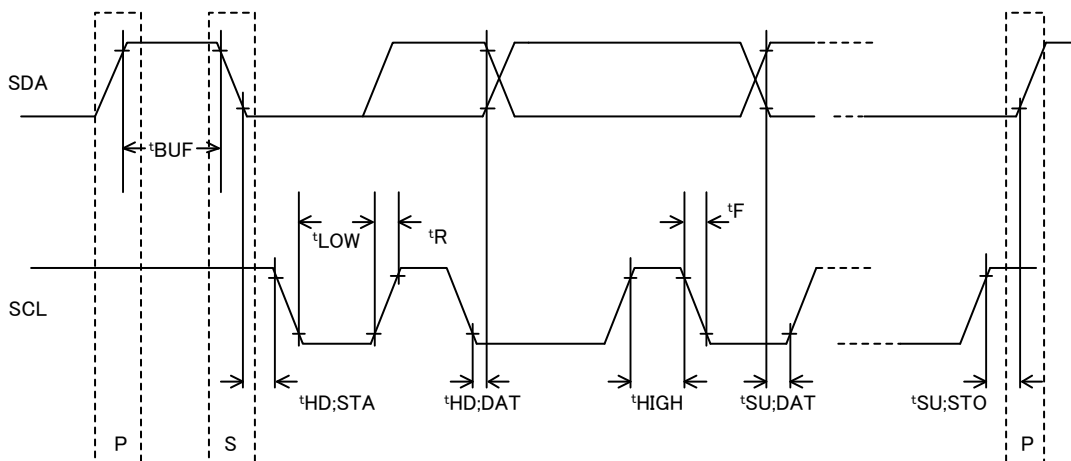Neither terminal SCL nor terminal SDA correspond to 5V tolerant.

Figure 28. I²C Bus line timing

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9. Interrupt terminal to microcomputer

9.1 BUSY
BUSY status detection output

Signal name	I/O	Function	Remarks
BUSY	O	BUSY status detection output signal	H: Busy, L: Not Busy

This is output to indicate that the LSI is in the BUSY status.
A BUSY signal outputs H until analyzing a command from the master and starting the command operation.
This LSI ignores command input during BUSY. Please connect it with the PIO port of the microcomputer.

9.2 MCHNG
Tune number change detection output

Signal name	I/O	Function	Remarks
MCHNG	O	Tune number change detection output signal	H: During playing, L: At the end or stop of tune

This signal outputs the information which tells that the file within the memory is being played or the file to be played is changed.
Precisely, the signal outputs H during the internal decode sequence operation, and L at stop of the operation.
Please connect it with the interrupt port of the microcomputer.

9.3 SEARCH
SEARCH status detection output

Signal name	I/O	Function	Remarks
SEARCH	O	SEARCH status detection output signal	H: SEARCH, L: Not SEARCH

This is output to indicate that the LSI is in the SEARCH status.
A SEARCH signal becomes H at the time of memory mount, file search, TAG analysis and TOC analysis.
The LSI ignores command input during SEARCH.
However, it can accept only ABORT, STOP and status read commands even during SEARCH and can execute them command.
Please connect it with the PIO port of the microcomputer.

9.4 IRPTO
Interrupt output to microcomputer

Signal name	I/O	Function	Remarks
IRPTO	O	Interrupt output to microcomputer	H: Interrupt, L: Not Interrupt

This is output to indicate that the LSI is now requiring interruption to the microcomputer.
Change from L to H shows that an interruption has occurred.
The contents of interruption change with the states where it is operating mode. The contents are shown below.
Please connect it with the interrupt port of the microcomputer.

Table 11. Interruption

State	Interruption	Contents
PLAYER MODE	ERROR	An interrupt occurs when memory connection error or communication error. Clear conditions; interruption is cleared by extraction and insertion of a memory.
FILE RW MODE File read	FRDREADY	An interrupt occurs when a specification file is searched and read-out is ready. Clear conditions; interruption is cleared by data are read (block unit).
FILE RW MODE File write	FWRREADY	An interrupt occurs when read-in is ready with memory. Clear conditions; interruption is cleared by data are write (block unit).
PLAY LIST MODE	ERROR	An interrupt occurs when memory connection error or communication error. Clear conditions; interruption is cleared by extraction and insertion of a memory.
CD-DA MODE	ENCEND	An interrupt occurs when encoding is completed and a file is CLOSE(ed). Clear conditions; interruption is cleared by file OPEN is carried out.
CD-ROM MODE	SEEK	An interrupt occurs when requiring necessary data (LBN). Clear conditions; interruption is cleared by required data are inputted.
IPL WRITE MODE	IPLMODEEND	An interrupt occurs when FLASH ROM rewriting end. Clear conditions; interruption is cleared by reset.

10. CD INPUT interface

Three-line Digital audio input interface

Signal name	I/O	Function	Remarks
LRCKI	I	LR clock input	
BCKI	I	BIT clock input	
SDATAI	I	Data input	
INREQI	I	Input data valid	H: Input data valid, L: Input data invalid
BFULLO	O	Internal buffer FULL output	H: Internal buffer FULL, L: Not FULL

This is a three-line Digital audio input interface terminal from a CD.
The data input from the interface is encoded in the MP3 or WAV format and written to the memory.
   * BU94702AKV and BU94705AKV only.
Input LRCK speed supports 2X max.
Builds in the CD-ROM decoder function.

10.1 Input format
   You can select the input format from the EIAJ format and I^{2}S format of 16 bits.
   You can select the BIT clock from 32fs, 48fs and 64fs.
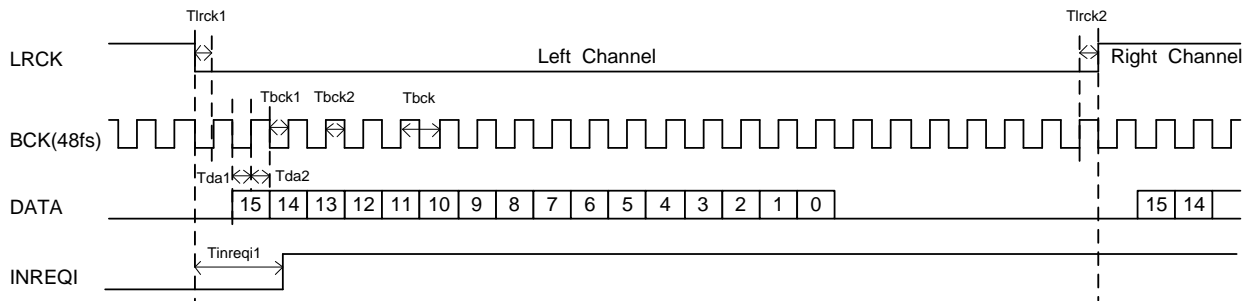   You can select the input sample frequency from 32 kHz, 44.1 kHz and 48 kHz.

Figure 29. I^{2}S Input format (48fs)
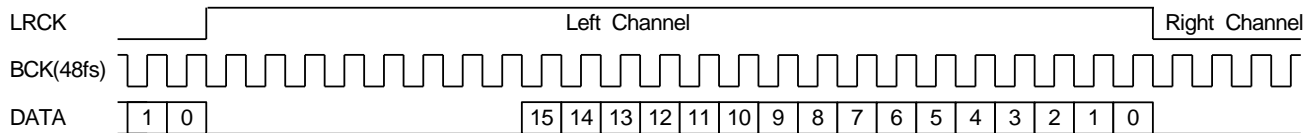
Figure 30. EIAJ Input format (48fs)

10.2 Timing
   Load=20pF

Table 12. Timing

(Unless specified, Ta=25°C, VDD1=3.3V, Load=20pF)

Item	Symbol	Rating			Unit	Remarks
		min	typ	max		
BCKI Low time	Tbck1	41	Tbck/2	-	ns	
BCKI High time	Tbck2	41	Tbck/2	-	ns	
LRCKI Setup time	Tlrck1	41	Tbck/2	-	ns	
LRCKI Hold time	Tlrck2	41	Tbck/2	-	ns	
SDATAI Setup time	Tda1	41	Tbck/2	-	ns	
SDATAI Hold time	Tda2	41	Tbck/2	-	ns	
INREQI Setup time	Tinreqi1	200	-	-	ns	
Input High Voltage	Vih	VDD1*0.7	-	-	V	
Input Low Voltage	Vil	-	-	VDD1*0.3	V	
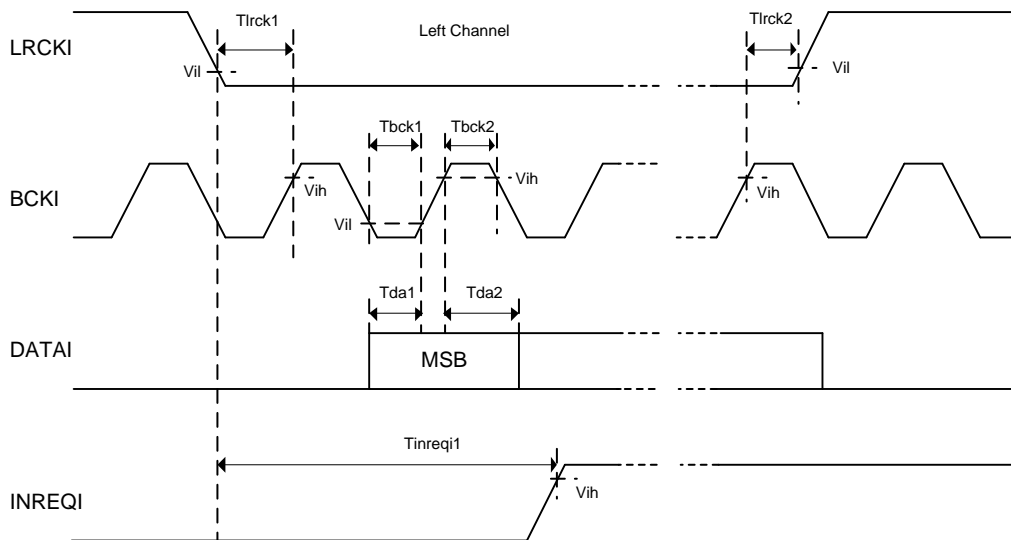
Figure 31. CD I/F Timing

10.3 INREQI
   INREQI inputs H from the microcomputer when the input data is valid.
   When INREQI=H and BFULLO=L, the IC fetches the input data to the internal buffer.

10.4 BFULLO
   BFULLO outputs H when the internal buffer becomes FULL.
   When INREQI=L and it is possible to become empty in an internal buffer, BFULLO outputs L.

11. Serial interface
Slave SPI serial interface

Signal name	I/O	Function	Remarks
SS_CS	I	Slave SPI chip select input	
SS_CLK	I	Slave SPI clock input	
SS_DI	I	Slave SPI data input	
SS_DO	O	Slave SPI data output	

This is a slave serial SPI interface terminal.
It supports the SPI format (MODE0, 1, 2 and 3).
You can select the data width from 8, 16 and 32 bit.
An input clock is 2MHz at the maximum.
The interface is available to read and write the specific file data from/to the memory.

11.1 Format
It supports the SPI format (MODE0, 1, 2 and 3).
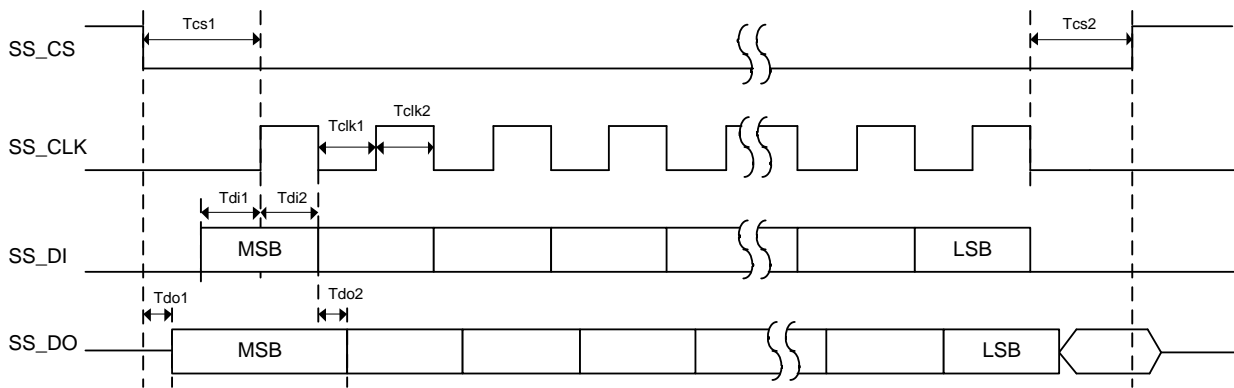
8 or 16 or 32bit − SPI MODE0 Serial Format (SCPH=0)
SS_CLK rise edge; data capture , fall edge; data shift
SPI MODE2 is opposite in the clock polarity in SPI MODE0.

Figure 32. SPI MODE0 Serial format
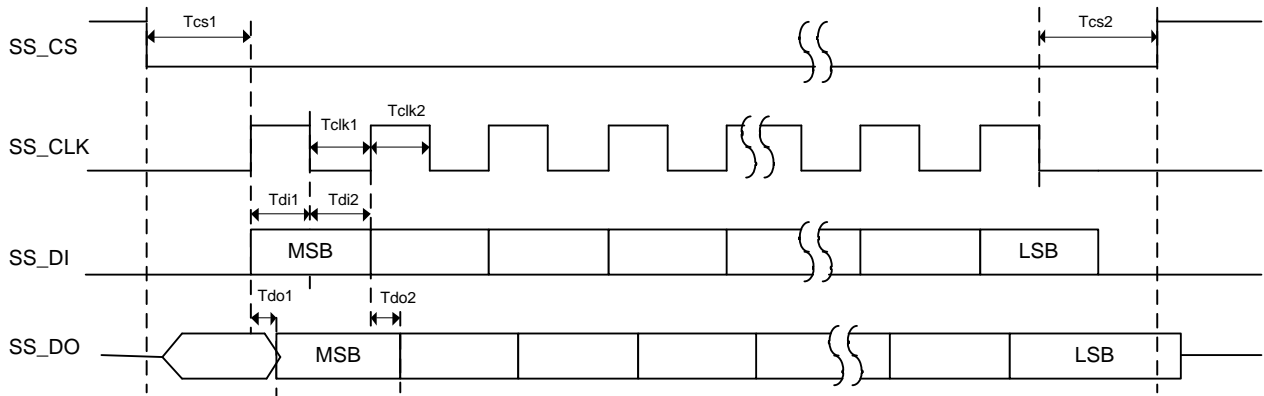
8 or 16 or 32bit - SPI MODE1 Serial Format (SCPH=1)
SS_CLK rise edge; data shift , fall edge; data capture
SPI MODE3 is opposite in the clock polarity in SPI MODE1.

Figure 33. SPI MODE1 Serial Timing

11.2 Timing

Table 13. Timing

(Unless specified, Ta=25°C, VDD1=3.3V, Load=20pF)

Item	Symbol	Rating			Unit	Remarks
		min	typ	max		
SS_CLK Low time	Tclk1	250	-	-	ns	
SS_CLK High time	Tclk2	250	-	-	ns	
pulse width controlled	-	-	-	100	ns	
SS_CS Setup time	Tcs1	500	-	-	ns	
SS_CS Hold time	Tcs2	250	-	-	ns	
SS_CS High time	Tcsh	0	-	-	ns	
SS_DI Setup time	Tdi1	100	-	-	ns	
SS_DI Hold time	Tdi2	100	-	-	ns	
SS_DO Output delay	Tdo1	-	150	-	ns	
SS_DO Output delay	Tdo2	-	150	-	ns	
Input High Voltage	Vih	VDD1*0.7	-	-	V	
Input Low Voltage	Vil	-	-	VDD1*0.3	V	
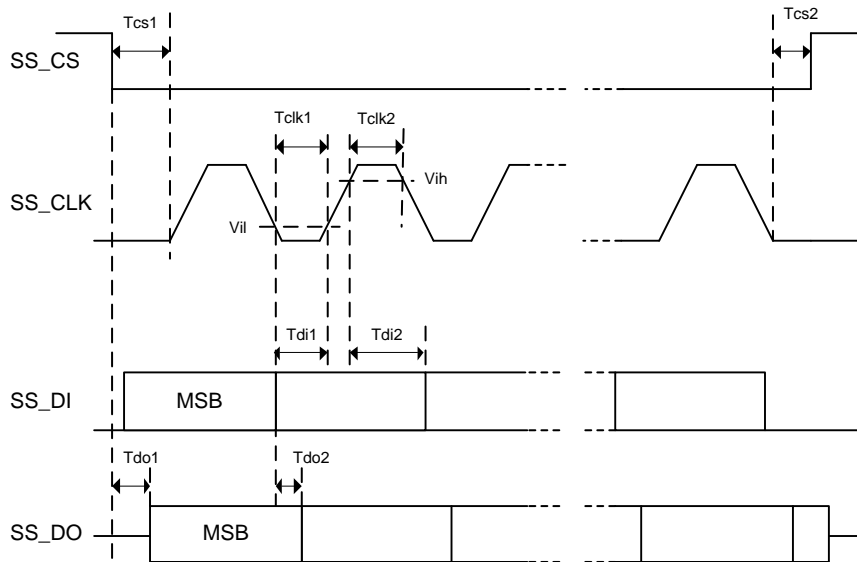
Figure 34. SPI Timing (MODE0 format)

12. SEL_USB

Preference device detection selection signal

Signal name	I/O	Function	Remarks
SEL_USB	I	Preference device detection selection signal	H: USB, L: SD

The signal selects which device should be detected with the highest priority at power ON.
When SEL_USB=H, the microcomputer detects the preference device from USB.   When SEL_USB=L, it detects the preference device from SD.
SEL_USB is set only at power ON only. Note that selection change will be ignored after power ON.

13. System Operation MODE

The LSI starts operation by setting up System Operation MODE after download of the program by IPL after a power supply and reset release.

Possible operation changes with each modes of operation.

Only the one mode can set up mode of operation with a command.

The mode which is simultaneously different cannot be set up.

A microcomputer sets up the change in System Operation MODE with a command.

It must change via the CONFIG mode when you change the operation mode.

The settlement of the following command is to do a re-setup because it is returned in the initial value when it passes through the CONFIG mode.

REPEAT, RANDOM, SET_EQ, SET_NEXT, SET_REPRAND, SET_TAG, SET_PRM

Command CHG_SYSTEM_MODE

Table 14. System Operation MODE

N	MODE	Explanation
0x00	CONFIG	It is in the state which changes after a power supply and download of the program by IPL. It is the mode which performs initial setting of a system. Please change to the mode of other operation after setting up with an initial-setting command. In this mode, even if it detects insertion of a memory, mount of a memory is not performed. The mount of a memory carried out behind each mode changes.
0x01	PLAYER	It is the mode which performs decoding play of the file in a memory. File browsing (structural analysis in a memory) can be performed.
0x02	FILE RW	It is the mode which Reading/Writing can perform about the specific file in a memory. A specific file can be deleted. File browsing (structural analysis in a memory) can be performed.
0x03	PLAY LIST	It is the mode which plays according to the specific playlist file in a memory.
0x04	CD-DA	It is the mode which encodes the input from CD-DA to MP3 (WAV) file, and writes it in a memory. *BU94702AKV and BU94705AKV only.
0x05	CD-ROM	It is the mode which analyzes and play(decoding) the input from CD-ROM.
0x07	IPL WRITE	It is the mode which uploads to outside serial Flash ROM from the specific data in a memory. A data file is offered from ROHM. The reset to the LSI is required for after data rewriting.

14. File search
14.1 Function
· The file search function supports file system of FAT32, FAT16 and FAT12. (NTFS is not supported.)
· The number of maximum playable files per folder.

Table 15. Maximum Playable Files per Folder

	Root folder	Sub folder
FAT12	512	65534
FAT16	512	65534
FAT32	65535	65534

The number of files described above includes folders and files other than playable files (WAV/AAC/WMA/MP3). Thus, if non-playable files or folders contain in the above folders and the number of total files exceeds the maximum limit, all the playable files may not be played.
· Less than 100 files in the order of FAT within each folder are sorted according to UNICODE.   More than 100 files, if any, will be sorted in the FAT order.   The same rule is applied when sorting sub-folders. More than 100 sub-folders, if any, will be sorted in the FAT order. A sorting function can be selected valid or invalid with a command.
· The folder hierarchies up to 16 hierarchies whose full path including the file name is within 260 characters can be searched.
· Supports the device size up to FAT specification (2T byte).
· Supports 512, 1024, 2048 and 4096 bytes per sector.

14.2 Playable file
The playable file extension is *.WAV for the WAV file, *.M4A, *.3GP and *.MP4 for the AAC file, *.ASF and *.WMA for the WMA file, and *.MP3, *.MP2 and *.MP1 for the MP3 file.   (There is no distinction between upper case letters and lower case letters.)   Note that the file operation differs in the following cases
· SET_MP3 : For details, see SET_MP3 command.
· Attribute   : Files with hidden attributes are also playable. Files with system attributes cannot be played.
· File name : The file name, including its size, does not depend on playability.
· File size   : A file with file size "0" is not recognized as a playable file. Playable file size up to 2G-1 byte. A file over 2Gbyte is recognized as a playable file, too. But, it is for 2Gbyte -1byte that it can play.

14.3 File playing sequence
The file playing sequence depends on the following rules when sort function valid. See Figure 35.
[1]   Files of 1 to 100, in the order written to FAT (FAT order) in each folder, are sorted in the order of UNICODE. Files more than 100 are played in the FAT order.   The same rule is applied when sorting sub-folders.
MP3 files are sorted for MP3 which conforms to SEL_MP3.   All the folders including null ones and those to which no playable file is written are sorted.   If over 100 playable files or sub-folders are contained in the folder, they are played in the order written to the FAT directory entries.
The writing method of directory entries will not help understand the file play order because the method depends on the OS operation at writing.
[2]   When a playable file exists in the root folder (the top hierarchy), the file is to be played first.
[3]   After all the playable files within the root folder have been played, playable files in the folder in the lower hierarchy, if any, are played.
[4]   If another folder exists in the lower hierarchy, playable files within this folder are played.   If not, the LSI searches other folders in the same hierarchy.   If another folder exists there, the LSI plays that folder.
[5]   After playing all the files, the LSI returns to the root folder as in [2] and play the files starting with the top sorted one.

14.4 Folder/File sort

The LSI sorts the sub-folders and files in the following sequence:

[1]   Obtain up to 100 sub-folders and files each in the order written to FAT within selected folder.

[2]   Compare the obtained folder/file names for 14 characters (28 bytes) from the beginning in UNICODE (2-byte character) and sort them in the ascending order. *

[3]   If there are files/folders with same character strings: follow the order of MP3, WMA, AAC and WAV when the extension is different; and, otherwise, follow the order written to FAT.

[4]   101 or more files or sub-folders follow the order written to FAT.

* The processing of the file name and the folder name is shown in the following.

1)   When a LFN (long file name) entry exists, 2 bytes are treated as one character.

2)   When no LFN entry exists, the SFN (short file name) entry is processed as follows.

2-a) When the first appeared character code is within the range of 0x00-0x7F (US-ASCII), the LSI treats one byte as one character, and adds '0x00' to the upper of the character to expand the entire character to an UNICODE.

2-b) For a case other than 2-a), practically, the LSI treats these 2 bytes as one character.

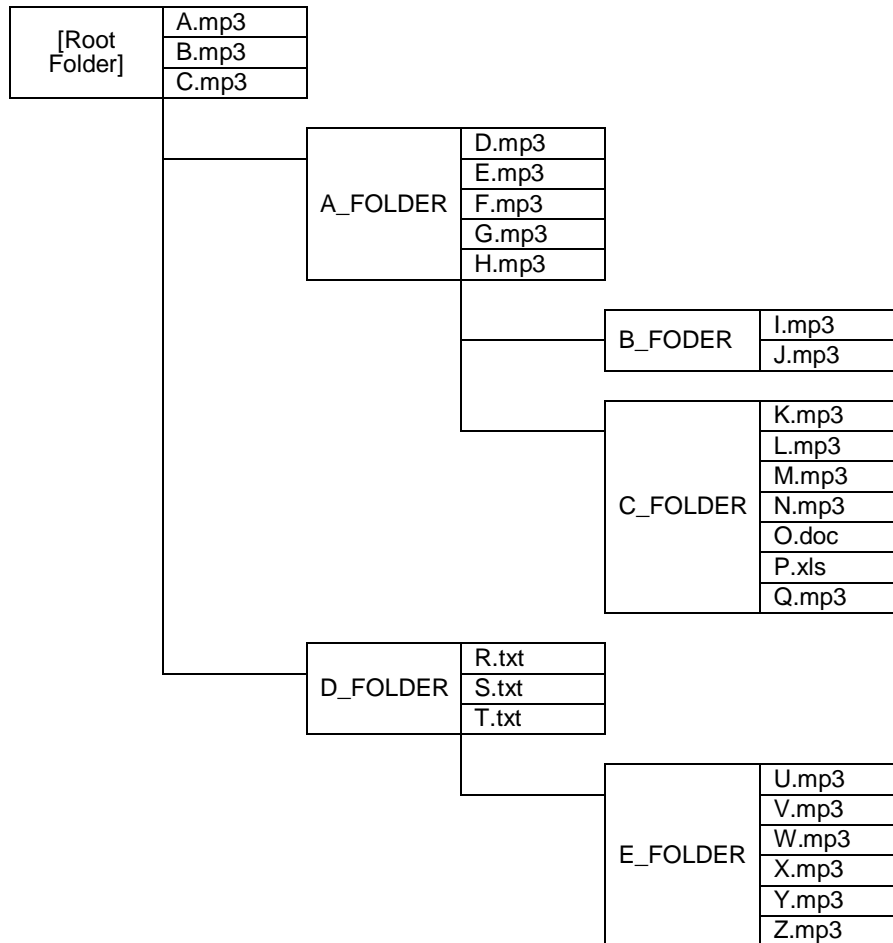*For details on LFN and SFN, see the FAT file system specifications.

Figure 35. Example of Folder/File Structure within the Memory Device

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Table 16. File Play Sequence for Folder/File Structure in Figure 35

Play order	File to be played	Remarks
1	A.mp3	-The LSI first starts playing the playable files in the root folder, if any. -The files are played in the ascending order of UNICODE given to each file name.
2	B.mp3	
3	C.mp3	
4	D.mp3	-After playing all the playable files in the root folder, the LSI searches folders in the lower hierarchy. -The folders are searched in the ascending order of UNICODE given to each folder name.
5	E.mp3	
6	F.mp3	
7	G.mp3	
8	H.mp3	
9	I.mp3	
10	J.mp3	
11	K.mp3	
12	L.mp3	
13	M.mp3	
14	N.mp3	
15	Q.mp3	-Unplayable files are ignored.
16	U.mp3	-After playing all the playable files including those in A_FOLDER and in its lower hierarchy, the LSI moves to the hierarchy in which A FOLDER exists and searches files. -In this case, since no playable file exists in D FOLDER, which is in the same hierarchy of A_FOLDER, the LSI plays the playable files in E FOLDER in the further lower hierarchy.
17	V.mp3	
18	W.mp3	
19	X.mp3	
20	Y.mp3	
21	Z.mp3	

14.5 Search within multi-drive and multi-partition

If a device is a multi-drive type, the LSI recognizes the drive having the smaller LUN (Logical Unit Number) for the supporting FAT.
Only one drive is recognized and the other drive is not.
For the multi-partition, the LSI recognizes only the first read FAT-supported partition.
Files in other partitions cannot be read.

14.6 External HUB search

When the USB connector is connected to a HUB, and a FAT-supported drive is connected ahead of the HUB at mounting the USB for this LSI, only one drive is recognized.
The LSI does not support external HUBs, it cannot detect plugging/unplugging of the drive ahead of the HUB after the USB is mounted.

15. Playing files

15.1 Function

For the files judged to be playable through the file search function, the LSI automatically switches the decoder using the file extension and decodes these files.

Fast forward play and rewinding play operations are available.

Also, repeat play and random play are available.

When the sample rate of the input file is not 44.1 kHz, the sample after the decode is converted into 44.1 kHz with sample rate converter (SRC) of building into and output.

15.2 Playable file formats

15.2.1 MP3 file format

This format supports MPEG Audio 1, 2, 2.5 and Layer 1, 2, 3.

It supports sample rates of 8 kHz, 16 kHz, 32 kHz, 11.025 kHz, 22.05 kHz, 44.1 kHz and , 12 kHz, 24 kHz and 48 kHz.

It supports bit rates of 8 to 320kbps and VBR (Variable Bit Rate).

15.2.2 WMA file format

This format supports WMA Ver.9 Standard.

It supports sample rates of 8 kHz, 16 kHz, 32 kHz, 11.025 kHz, 22.05 kHz, 44.1 kHz and 48 kHz.

It supports bit rates of 5 to 384kbps and VBR (Variable Bit Rate).

It does not support DRM.

It supports ASF files including audio streams only.

15.2.3 AAC file format

This format supports MPEG4 AAC-LC.

It conforms to ITunes and 3GPP TS 26.244.

It supports file types of m4a, mp4 and 3gpX. (X is an arbitrary numeric value.)

ITunes is validated in the following versions: 4.*, 5.*, 6.* and 7.0-7.5.

It supports sample rates of 8 kHz, 16 kHz, 32 kHz, 11.025 kHz, 22.05 kHz, 44.1 kHz, 12 kHz, 24 kHz and 48 kHz.

It supports bit rates of 8 to 320kbps and VBR (Variable Bit Rate).

It does not support DRM. It does not support CD-ROM playing.

15.2.4 WAV file format

This format supports RIFF WAVE.

It supports sample rates of 8 kHz, 16 kHz, 32 kHz, 11.025 kHz, 22.05 kHz, 44.1 kHz, 12 kHz, 24 kHz and 48k Hz.

It does not support CD-ROM playing.

15.3 Playing files having damaged data

Operation to the file of all non-correspondence formats is not warrantable. Operation when abnormality of the file is detected with this LSI is as follows.

If the data section of the MP3 file is damaged, the LSI plays the music data in the possible range instead of ceasing to play the entire file.   It mutes the unplayable section.   However, AMUTE terminal remains H output.

If the data section of the WAV file is damaged, noises are output.

The LSI executes other files within the playable range and stops playing. Then, it skips to the next tune.

If a part of the data header is damaged, the LSI immediately terminates playing and skips to the next tune.

If the file's extension is playable but its file's data does not have a format supporting to the extension, the LSI immediately terminates playing and skips to the next tune.

If the file does not have a file format, the LSI immediately terminates playing and skips to the next tune.

However, when the file data is structured in a format other than MP3 and its file extension is *.MP3, *.MP2 or *.MP1, the LSI plays it in the silence mode basically.   However, if the LSI can read any playable data, it plays the file partially.

In this case, the time information which is output as the serial status also becomes unstable. The time information is then partially output but you cannot obtain the correct information.

15.4 NEXT playing mode and Repeat playing mode
You can select the operation as shown below depending on the next playing mode, repeat mode and random mode.

Next playing mode
[1]	PLAY_NEXT	: Automatically searches the next tune after the tune being played ends and starts playing the next tune.
[2]	PLAY_ALL_STOP	: After the last tune being played within the memory ends, stops upon completion of search for the next tune. Starts playing the next tune by the play command issued subsequently.
[3]	PLAY_FOL_STOP	: After the last tune being played within the folder ends, stops upon completion of search for the next tune. Starts playing the next tune by the play command issued subsequently.
[4]	PLAY_TUN_STOP	: After the tune being played ends, stops upon completion of search for the next tune. Starts playing the next tune by the play command issued subsequently.

Repeat mode
[1]	REPEAT_ALL the	: After playing all the tunes within the memory in process, starts playing them from beginning of the memory.
[2]	REPEAT_FOL	: Repeats playing tunes within the folder in process.
[3]	REPEAT_TUN	: Repeats playing the tune in process. The operation when the FF and FB command is received follows the setting of the SET_REPRAND command.
[4]	RANDOM_ALL the	: Plays the range of ±128 files from the current tune being played at random within memory.
[5]	RANDOM_FOL the	: Plays the range of ±128 files from the current tune being played at random within older in process.

Random operation is a specification that doesn't continuously play the immediately played tune not the shuffle operation that doesn't play the played tune before.
Select one operation from next play mode and repeat mode respectively to determine the operation.
When repeat mode is REPEAT_FOL, the PLAY_ALL_STOP becomes invalid, and serves as PLAY_NEXT.
When repeat mode is [3] [4] [5], the PLAY_ALL_STOP and PLAY_FOL_STOP becomes invalid, and serves as PLAY_NEXT.

Table 17. Next play mode and repeat mode

	REPEAT_ALL	REPEAT_FOL	REPEAT_TUN	RANDOM_ALL	RANDOM_FOL
PLAY_NEXT	○	○	○	○	○
PLAY_ALL_STOP	○	✕	✕	✕	✕
PLAY_FOL_STOP	○	○	✕	✕	✕
PLAY_TUN_STOP	○	○	○	○	○

15.5 Resume playing function
The LSI can read the resume information to the microcomputer, the resume playing will be enabled using this information.

Table 18. Resume information register structure

Status OFFSET	The number of bytes	NAME	Contents
0x38-0x61	42	Resume information data	This data shows the information on the file being played and on the play position. The data has a LSI-unique structure. The resume information data is data of 42 bytes. It outputs with a little endian.

The above resume information has a LSI-unique structure and is used when executing resume play. Therefore, you should use the data contents as they are without rewriting.
The resume function is implemented by writing the resume information read by READ_RESUME_INFO command to PLAY_RESUME command. After writing to PLAY_RESUME, the LSI automatically searches the resume file and plays it.
After reading READ_RESUME_INFO command during file play, the LSI resumes the file from the time READ_RESUME_INFO has been read.
The data contents read by READ_RESUME_INFO command cannot assure the operations when executing PLAY_RESUME which has been rewritten due to the positional information within the memory. If the resume information does not match because of change of memory, the LSI starts playing the first tune.

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15.6 File Name, Folder Name, TAG Information
A file name, a folder name, and TAG information are outputted to a status register.
The first 2 bytes to be output indicate file data ID information.
The target data is outputted from the 3rd byte.
A file name, a folder name, and TAG information status register structure are shown in Table 19.

Table 19. File (folder, TAG) information register structure

Status OFFSET	The number of bytes	NAME	Contents
0x38	1	Data type	The type of data is outputted. 0x00; TEXT- NUL (0x00) Terminated character string 0x01; BYTE- Unsigned 1 byte integer
0x39	1	Encoding	Encoding of a character string is outputted. 0x00 ; ISO8859-1(Latin1) 0x01 : UTF-16(with BOM) 0x02 : UTF-16BE 0x03 : UTF-8 0x49 : UTF-16LE When a data type is except 0x00: TEXT, data length (byte unit) is outputted.
0x3A-0xB9	128	File name (Folder name, TAG)	A file name (or a folder name, TAG) is outputted by left fitting. Up to 128 bytes can be output. If the data is less than 128 bytes, it terminates with 0x00.

The full path within the memory to which a file exists is outputted to a status register.

Table 20. File path information register structure

Status OFFSET	The number of bytes	NAME	Contents
0x38	1	Data type	The type of data is outputted. 0x00; TEXT- NUL (0x00) Terminated character string 0x01; BYTE- Unsigned 1 byte integer
0x39	1	Encoding	Encoding of a character string is outputted. 0x00 ; ISO8859-1(Latin1) 0x01 : UTF-16(with BOM) 0x02 : UTF-16BE 0x03 : UTF-8 0x49 : UTF-16LE When a data type is except 0x00: TEXT, data length (byte unit) is outputted.
0x3A-0x139	256	File path	A file path is outputted. The delimiter between folder layers is "¥" (0x5C). Up to 256 bytes can be output. If the data is less than 256 bytes, it terminates with 0x00. For USB, the data starts with"A:¥"; for SD, with"B:¥".

The character code information on TAG information is outputted to a status register.

Table 21. Character code information register structure

LANGH OFFSET=0x11	LANGL OFFSET=0x10	Language Code
0x00	0x00	ID3V1 TAG or ISO8859-1(ID3V2 TAG)
0x00	0x01	UTF-16 (ID3V2 TAG)
0x00	0x02	UTF-16BE (ID3V2 TAG
0x00	0x03	UTF-8 (ID3V2 TAG or AAC TAG iTunes Meta-data)
0x00	0x49	UTF-16LE (WMA TAG)

16. File browsing within memory

The LSI can analyzing and reading of the entry information of files and subfolders within a folder which is different from the one having the current tune while the current tune is being played or stopped. Since the read information contains access data to be used to select tunes, the LSI enables to directly select and play tunes using this data.

The file browsing in the memory operates the cursor (operated position) that can be operated.

When sending the command to move the cursor, the LSI can analyze and read the information of 10 entries (files or folders) from the move destination. (The number of entries can be changed by the setting of SET_BROWSE_NUM.)

The cursor movement conforms to the sort order determined by the sort function.   If the sort function is enabled, the system first reads the files, and then the subfolders, in the sort order.   If the sort function is disabled, the LSI reads the files and subfolders in the order that they are written to FAT.

A file browsing function becomes effective after ANALYSE_ROOT command is send, and starts the analysis in a root folder.

When you select music directly by using the access data or cursor position, the following status doesn't return a normal value because it doesn't understand the number in the whole in the memory.

  Playing folder number status in memory, Playing file number status in the memory.

The file information status register structure which can be read by the file browsing function in a memory is shown in Table 22.

Table 22. File (folder) information register structure

Status OFFSET	The number of bytes	NAME	Contents
0x38-0x3D	6	Access data	The position in the memory in which a file and folder information is written is shown. Direct song selection is possible from a microcomputer using this data.
0x3E	1	Entry type	The type of file is outputted. 0x0Y= file-native (LFN, SFN), 0x1Y= folder-native (LFN, SFN) 0x8Y= file-UTF16LE (LFN), 0x9Y= folder-UTF16LE (LFN) Y becomes the following cases. 0x1=MP3, 0x2=WMA, 0x3=AAC, 0x4=WAV , 0x5=PLAY LIST, 0x6-0xE=reserve, 0xF,0x0=other file
0x3F	1	-	0x00
0x40-0x43	4	Cluster number	The cluster number in the memory in which a file and folder information is written is shown.
0x44-0x84	64	File name (Folder name)	A file name (folder name) is outputted by left fitting.

Cautions)

If browsing operation is frequently performed during music plaing, music skipping may occur by the memory with a slow access speed.

17. Play list play

When PLAY LIST MODE of the system operation mode has been selected, this function is effective.

The LSI can search the play list in the specified folder within the memory and output the play list information.

When the microcomputer selects the play list, the LSI plays the selected tunes in the order written to the play list.

Also, the LSI can output the file information in the selected play list.

Available playlist file should have an extension of M3U or PLS and be described in full path using ASCII or the SET_LANG command setting.

The full path of a file described in the playlist should be within 256 bytes and within 16 hierarchies.

If the play list format is other than the above or the path does not match, the LSI skip playing tunes.

While playing the tunes in the playlist, PLAY, STOP, PAUSE, FF and FB commands can be used to control the list.

The music file described during the play list is treated as what exists in the flat of one class (only root folder) within a memory irrespective of the place (path) where the file exists really. For this reason, it becomes invalid a folder repeat and a folder random command, and it becomes effective the repeat in a memory, one music repeat, and random in a memory setting up a repeat setup by the SET_REPRAND command.

18. File data write and File data read

When FILE RW MODE of the system operation mode has been selected, this function is effective.
It is possible to read the contents of data of the specification file in a memory.
It is possible to create a data file in a memory.
The full path including a file name and an extension supports to 16 classes within 256 bytes.
The full path is acquirable with browsing operation.
Deletion of a file is possible at the time of browsing operation.

19. CD data ripping

*BU94702AKV and BU94705AKV only.

When CD-DA MODE of the system operation mode has been selected, this function is effective.
This function encodes a three-line Digital audio input data from a CD to MP3 (or WAV) format and writes it to the memory.
The full path of file supports to 16 classes within 256 bytes.
The LSI can also write TAG data of TITLE, ARTIST, ALBUM, and GENRE of up to 64 bytes each to the encoded file.

19.1 Input supporting formats
16-bit EIAJ format or 16-bit I^{2}S format
Sample rate: 32 kHz, 44.1 kHz, 48 kHz
Bit clock: 32 fs, 48 fs, 64 fs LRCK
LRCK input speed: MAX=2 X speed

19.2 Encode format
MPEG1 Audio Layer3 (extension: MP3) stereo
Bit rate: Selectable from 32 kbps, 64 kbps, 128 kbps, 192 kbps, 256kbps and 320 kbps
Sample rate: Input sample rate

WAV 16bit PCM stereo
Bit rate: 1411.2kbps
Sample rate: Input sample rate

19.3 Valid data to be encoded

When LRCK is switched from Rch to Lch and all of the following conditions are met, input data is written to the internal buffer as valid data and encoded to MP3.

[1]   The command to enable the encode function turns ON.
[2]   BFULLO output terminal is set to L.   (The internal buffer is not FULL.)
[3]   INREQI input terminal is set to H.   (The microcomputer tells that this data is valid.)

When the internal buffer becomes FULL and cannot receive the data, BFULLO terminal output H. Then, data writing to the internal buffer will stop.

When the internal buffer generates space after processing data and INREQI input terminal is set to L, BFULLO output terminal is set to L.
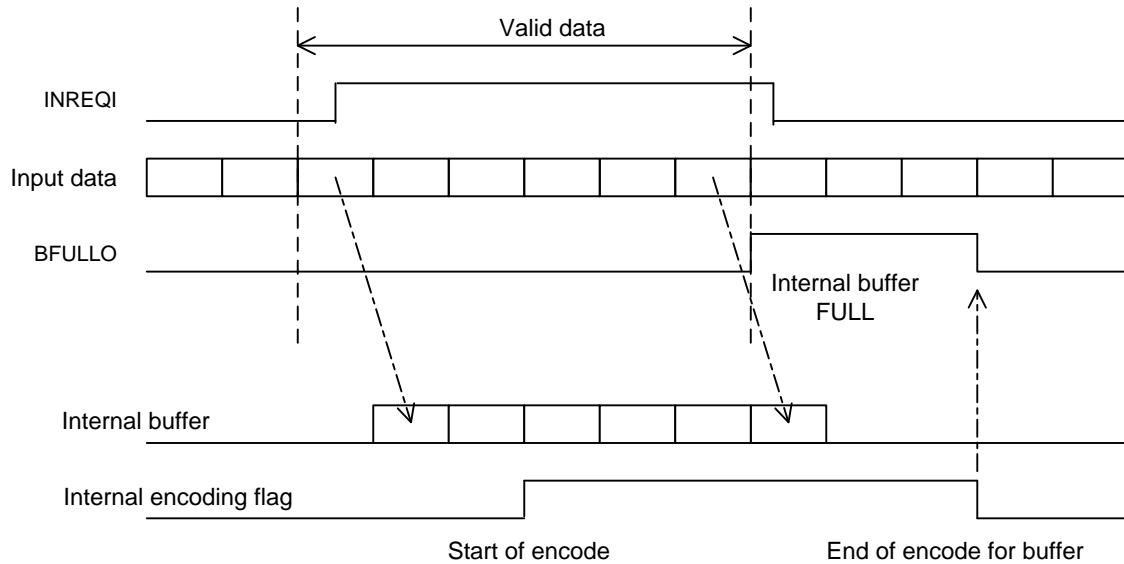
Figure 36. Valid data to be encoded

19.4 Data comparison connection function

When you assume the comparison connection operation to be effective, the data newly input as the last 3 samples of the valid data input before the comparison connection operation is set is compared.

LSI restarts the input from the following data to an internal buffer when 3 consecutive samples are corresponding everything.

As a result, it becomes consecutive data before and after doing connected operation.

When you assume the comparison connection operation to be invalid, encode can be restarted by connecting it directly by controlling the INREQI input.

19.5 Encode speed

The data writing speed to the memory depends on the state of the fragmentation and the usage condition in the memory, response time from the memory.

Therefore, the encode speed that BFULLO doesn't become H for all media cannot be guaranteed.

BFULLO both becomes H while recording MP3 and WAV, and the memory that cannot be in real time recorded exists.

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20. CD-ROM Decoder

When CD-ROM MODE of the system operation mode has been selected, this function is effective.
File system analysis and decoding of data are performed to 3 line serial input data from CD-ROM format.
CD-ROM ECC and the EDC function are supported.

20.1 Support File System

CD-ROM Mode1, Mode2 form1, and Mode2 form2 are supported.
The file system supports ISO9660 level 1 and 2. Remeo and Joliet extension are supported.
The folder class which can be searched support by 8 classes.
A folder name and a file name are acquirable to 48 bytes.

20.2 File system analysis

The number of entries that can be maintained in the buffer for the analysis becomes
3*(File_Number)+ 4*(Folder_Number)=1200.
It depends on the content of the composition of each CD-ROM.
It becomes a 266 files when number (Folder_Number) of folders is 100 and it becomes 366 entries in total (file or folder).
The entry which was not able to be held to the buffer domain for analysis cannot be played after file system analysis.
The result of the file system analysis can be read by the status output.

20.3 Playable file

20.3.1 MP3 file format

This format supports MPEG Audio 1, 2, 2.5 and Layer 1, 2, 3.
It supports sample rates of 8 kHz, 16 kHz, 32 kHz, 11.025 kHz, 22.05 kHz, 44.1 kHz and , 12 kHz, 24 kHz and 48 kHz.
It supports bit rates of 8 to 320kbps and VBR (Variable Bit Rate).

20.3.2 WMA file format

This format supports WMA Ver.9 Standard.
It supports sample rates of 8 kHz, 16 kHz, 32 kHz, 11.025 kHz, 22.05 kHz, 44.1 kHz and 48 kHz.
It supports bit rates of 5 to 384kbps and VBR (Variable Bit Rate).
It does not support DRM.
It supports ASF files including audio streams only.

20.3.3 CD-ROM play

Data is required for the CD-ROM reproduction operation to be input so that the internal data buffer should not empty. Therefore, when the data input from CD is not in time, and the internal data buffer empties, the music skip is generated.
The voice is not output while the microcomputer from the SEEK demand interrupt to the input of the demanded data is controlling the CD data input when fast-forwarding, rewinding by the CD-ROM playing.

20.4 SEEK request

The status of the LBN of required data is outputted when a file analysis start and file selection.
Furthermore, SEEK request interruption is outputted from an IRPTO terminal to a microcomputer at this time.
If a request sector is inputted, it will be automatic, connection operation will be performed and subsequent data will be processed.

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20.5 File, Folder, CD Volume Information
The status of the CD file system analysis result is outputted by READ_CD_FOL and a READ_CD_FILE command.
If the 0th is specified by the READ_CD_FOL command, the volume information on CD will be outputted.
A file, a folder, and volume information status register structure are shown below.

Table 23. CD files information register structure

Status OFFSET	The number of bytes	NAME	Contents
0x38-0x39	2	Parent folder number	A parent folder number is outputted. A route becomes No. 1.
0x3A-0x3B	2	File number	A file number is outputted.
0x3C-0x3F	4	File size	File size is outputted.
0x40-0x43	4	File LBN	LBN of the file head is outputted.
0x44	1	Extension type	An extension (file kind) is outputted. 0x01 : MP 3 0x02 : WMA 0x03-0x0E : Reserved 0x00 and 0x0F : Other files
0x45	1	Identifier length	The identifier length (byte) recorded on DISC is outputted.
0x46	1	-	0x01
0x47	1	Data length	Data length is outputted.
0x48-0x77	48	File name	A file name is outputted by left fitted. Up to 48 bytes can be output. A data type is outputted as BYTE.

Table 24. CD folder information register structure

Status OFFSET	The number of bytes	NAME	Contents
0x38-0x39	2	The number of subfolders	The number of subfolders is outputted.
0x3A-0x3B	2	The number of playable files	The number of playable files is outputted.
0x3C-0x3D	2	Parent folder number	A parent folder number is outputted. A route becomes No. 1.
0x3E-0x3F	2	Folder number	The present folder number is outputted.
0x40-0x43	4	Folder LBN	LBN of the folder head is outputted.
0x44	1	-	reserve
0x45	1	Identifier length	The identifier length (byte) recorded on DISC is outputted.
0x46	1	-	0x01
0x47	1	Data length	Data length is outputted.
0x48-0x77	48	Folder name	A folder name is outputted by left stuffing. Up to 48 bytes can be output. A data type is outputted as BYTE.

Table 25. CD volume information register structure

Status OFFSET	The number of bytes	NAME	Contents
0x38-0x39	2	The number of total folders	The number of total folders is outputted.
0x3A-0x3B	2	The number of total playable files	The number of total playable files is outputted.
0x3C-0x3F	4	Path table LBN	LBN of the path table (L type) currently recorded on effective VD is outputted
0x40-0x43	4	Root folder LBN	LBN of the root folder head is outputted.
0x44	1	VD type	VD type is outputted. 0x00 : PVD 0x01 : SVD
0x45	1	Identifier length	The identifier length (byte) recorded on DISC is outputted.
0x46	1	-	0x01
0x47	1	Data length	Data length is outputted.
0x48-0x67	32	Volume name	A volume name is outputted by left stuffing. Up to 32bytes can be output. A data type is outputted as BYTE.

21. Previous Command Processing Situation

The previous command processing situation is outputted as status register STATUS6 (OFFSET=0x05) PRECOMSTAT.
Bit0 of STATUS6 (OFFSET=0x05) and Bit2 of STATUS2 (OFFSET=0x01) is the same value. When Bit2 of STATUS2 set to "0", the previous command is normally processed. When Bit2 of STATUS2 set to "1", the previous command is not processed.
The following shows the value descriptions.

Table 26. Previous command processing

Value	NAME	Cause of being unprocessed
0x01	UNCLASSIFIED	Non classification error
0x03	UNKNOWN CMD	Undefined command
0x05	SEARCH	Searching now
0x07	INVALID ARG	Invalid parameter is detected.
0x09	WRONG MODE	Invalid command in the current system operation mode
0x0B	NOT READY	Initialization is not completed.
0x0F	NOT IMPLEMENTED	The function is not mounted.
0x11	WRITE PROTECTED	The device is write-protected.
0x13	DISK FULL	The memory has no free space.
0x15	DEVICE ERROR	Device error

22. Selected memory information

The kind and information on a device which are selected now are outputted by the READ_MEMINFO command.
The details of an output value are shown below.

Table 27. Selected memory information

Value[7:4]	Contents
0x0	Mounted USB device (playable device)
0x1	NO-Mounted USB device (file system un-support, etc)
0x2	USB LOW SPEED device
0x3	USB device with two or more DEVICE CONFIGRATION
0x4	USB device which cannot be recognized
0x5	-
0x6	-
0x7	SD Card
0x8-0xF	It means that there is HUB, when Bit7 is H.

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23. Process information when a media mount error

The information on in which stage of media mount it failed with the READ_MOUNT_ERROR command is outputted. After being set to ERROR=1, by reading this command shows in detail whether the error has occurred during which process execution.

For example, when ERROR=1 and 1st byte=0x08 or 0x09 of READ_MOUNT_ERROR command, since a response mistake is made from the device in the process of TEST UNIT READY or REQUEST SENSE, it becomes a mount error. The details of an output value are shown below.

1st byte (offset=0) of a read value outputs the process state at the time of USB mount.

Table 28. The process state at the time of USB mount

Read value	Process state	Read value	Process state
0x00	Before a start of operation	0x10	GET_DEVSTATUS
0x01	Device descriptor	0x11	Sector read command send
0x02	SET_ADDRESS	0x12	Sector read command receive
0x03	Configuration descriptor	0x13	Sector read status receive
0x04	End Point connect	0x14	Sector write command send
0x05	SET_Configuration	0x15	Sector write command receive
0x06	GET MAX LUN	0x16	Sector write status receive
0x07	CLEAR_FEATURE	0x17	Not-supported Device Subclass
0x08	INQUARY	0x18	HUB only
0x09	TEST UNIT READY	0x19	LOW DEVICE detect
0x0A	REQUEST SENSE	-	-
0x0B	READ_CAPACITY	-	-
0x0C	CLEAR_PORT_FEATURE	-	-
0x0D	GET_PORT_STATUS	-	-
0x0E	SET_PORT_FEATURE	-	-
0x0F	HUB descriptor	-	-

2nd byte (offset=1) of a read-out value outputs the process state at the time of SD initialization.

Table 29. The process state at the time of SD initialization

Read value	Process state
0x00	Before a start of operation
0x01	CMD0 Response
0x02	CMD8 Response
0x04	CMD55 Response
0x08	CMD41 Response
0x10	CMD58 Response
0x20	CMD1 Response

10th byte (offset=9) of a read-out value outputs the process state at the time of FAT file system analysis.

Table 30 the process state at the time of FAT file system analysis

Read value	Process state
0x00	Before a start of operation
0x01	MBR read
0x02	MBR Analysis
0x03	BPB Analysis
0x04	FAT table check

24. Watchdog Timer

The LSI incorporates Watchdog Timer, which monitors the system hang-up and resets whenever it occurs.

After resetting hang-up, WDT (Watchdog Timer) becomes available. You can disable WDT using DIS_WDT command. Once WDT is disabled, it cannot be enabled until reset is input.

When WDT, in the valid status, detects a hang-up within the LSI regardless of external situations (on the microcomputer), the LSI resets the system internally.

To monitor whether the LSI is reset by WDT from the master microcomputer (external), use SET_WDT command to write H to STATUS WDT_RFLG and monitor this status. After reset, this status is read as L. This helps you judge that WDT has reset the LSI by reading out L when reading the status regularly after writing H using SET_WDT command.

25. IPL support to external serial FLASH ROM

Once reset, the LSI needs to download the program to a part of the internal program area from the external serial FLASH ROM.

However, it is also possible to write in data from a microcomputer without connecting external serial FLASH ROM.

The download function from the external serial FLASH ROM enables to add and change the system functions simply by rewriting the external serial FLASH ROM.

The program is downloaded automatically after reset. After download is completed, it shifts to CONFIG mode.

This LSI supports to serial FLASH ROM to 8 bit-Command, 24 bit-ADDRESS, and clock MIN=15MHz by minimum size 2Mbit. This LSI cannot correspond to serial FLASH ROM that doesn't correspond to Page Program because the data writing is done with Page Program (256 bytes). This LSI supports to serial FLASH ROM to Write Status Register cycle time MAX. = 500msec, Page Program cycle time MAX. = 500msec and Chip Erase cycle time MAX. = 180sec.

The download time of the program from serial FLASH ROM is about 0.6 sec. This time changes with contents of the program write in serial FLASH ROM.

The LSI supports a mode which enables to write the program data written to the memory (USB or SD) to the external serial FLASH ROM. By executing the command to enable the FLASH ROM write mode, the LSI searches in the memory and rewrites the external serial FLASH ROM. After rewriting the FLASH ROM, you should reset the LSI.

26. Command

26.1 Control Command

The LSI allows command operations from an external microcomputer via a slave I²C serial interface.

The command length to be sent varies depending on the command.

Table 31 shows the command specifications.

Table 32 shows enabled/disabled state of each command.

Table 31. Command Operations

Command name	Command length	Command				Explanation of operation
		1st	2nd	3rd	4th	
CONFIG						
CHG_SYSTEM_MODE	4	0x60	0x00	N	0x00	・Set up System Operation Mode. ・Please choose 3rd byte N from the following. The other setup does not receive a command. 　N= 0x00 ; CONFIG Mode 　N= 0x01 ; PLAYER Mode 　N= 0x02 ; FILE RW Mode 　N= 0x03 ; PLAY LIST Mode 　N= 0x04 ; CD-DA Mode (*1 BU94702AKV and BU94705AKV only.) 　N= 0x05 ; CD-ROM Mode 　N= 0x07 ; IPL WRITE Mode The initial setting is N= 0x00.
STOP	2	0x60	0x01	-	-	・When receiving the STOP command, end the present processing and shift to the initial state in each system operation mode. ・Playing of a file will be stopped when receiving the STOP command during Playing, a stop, and file search. ・Playing of a file will be stopped when receiving the STOP command during fast forward or fast back Playing. ・After stopping playing the file, the LSI restarts playing it from the tune being stopped.　However, if the memory is removed and new one is inserted before restarting, the LSI returns to the top tune of the memory.
ABORT	4	0x60	0x02	0x01	0x00	・Suspends folder analysis. After suspend, the analysis state becomes "not analyzed" and the cursor position becomes invalid. In order to reset this status, it is necessary to transmit an ANALYZE_ROOT command, and it is necessary to make the cursor position valid. After ANALYZE_ROOT command, contents acquisition of a desired folder can be performed. It is not necessary to analyze intermediate folders one by one from a route folder. ・The LSI suspends analysis only and continues playing the file when receiving the ABORT command.
CHG_DEV	2	0x60	0x03	-	-	・This command select device between USB memory and SD memory card. To do this, both devices must be connected or one device is provided against the other (USB memory against SD memory card, and vice versa). Any other cases will be ignored. ・After the device is selected, the system operation mode remains the previous mode (before selecting) and goes to the initial state. ・The setting values of the individual commands remain as they are. However, those of the REPEAT and RANDOM commands return to the initial values
DIS_WDT	2	0x60	0x04	-	-	・This command disables Watchdog Timer. ・Initial setting is that Watchdog Timer function is effective.
SET_WDT	2	0x60	0x05	-	-	・This command writes "1" to STATUS WDT_RFLG when it is executed.
SET_SORT	4	0x60	0x06	N	0x00	・Set up file sorting operation in a memory. ・Select N at the 3rd byte from the following.　Any setting other than N=0x00 is considered to specify N=0x01. 　N=0x00: Disables sorting of files/folders. 　　　　　　　　Data is read out in the order that is written to FAT. 　N=0x01: Enables sorting of files/folders. ・Initial setting is N= 0x01. A sorting function is effective.

SET_12MOUT	4	0x60	0x07	N	M	・ Set up CLKOUT12 terminal and a TEST12 terminal output.
						・ Select N at the 3rd byte from the following. Any other settings will not accept the command.
						  N=0x00: Disables 12 MHz clock output from the CLKOUT12 terminal.
						  N=0x01: Enables 12 MHz clock output from the CLKOUT12 terminal.
						・ Select M at the 4th byte from the following. Any other settings will not accept the command.
						  M=0x00: Disables 16.9344 MHz clock output from the TEST12 terminal.
						  M=0x01: Enables 16.9344 MHz clock output from the TEST12 terminal.
						・ The 16.9344 MHz clock is a clock which buffers the input from the XIN_PLL terminal.
						・ initial setting is N= 0x00 and M= 0x00. Output is invalid.

SET_LANG	4	0x60	0x08	N	M	・ Set up a NATIVE language. ・ Select N and M at the 3rd and 4th bytes from the following. Any other setting is considered to specify {M, N}={0x00,0x00}: ASCII. { M, N }= { 0x03, 0xA4 }: SHIFT-JIS(CP932) { M, N }= { 0x03, 0x52 }: OEM_850 ・ Initial setting is {M , N} = {0x03, 0xA4} ; SHIFT JIS(CP932).

SET_MP3	4	0x60	0x09	N	0x00	・ Select the layer of the MPEG audio to play.
						・ Select N at the 3rd byte from the following. Any setting other than N=0x00 is considered to specify N=0x01.
						  N=0x00: Plays all the files having extension mp1, mp2, and mp3.
						  N=0x01: Plays the files having extension mp3 only.
						・ Initial setting is N= 0x00. All the files of mp1, mp2, and mp3 are reproduced.

SET_BROWSE_NUM	4	0x60	0x0A	N	0x00	・ Specify the number of entries (a file or folder) when enabling a browsing function which carries out prediction analysis. ・ Specify N at the 3rd byte within the range from 0x00 to 0x14(20). Any other settings will not accept the command. ・ The LSI analyzes entries in the number specified by N. ・ Since even (0-N) can specify with the parameter of 'READ_BROWSE_INFO', N+1 entry information can be acquired at the maximum. ・ Initial setting is N=0x0A=10 entry prediction analysis.
SET_PLAYINFO_NUM	4	0x60	0x0B	N	0x00	・ Specify the number of files predicted by the READ_PFILE_NAME command. ・A READ_PFILE_NAME command can be predicted only within the same folder. ・ Specify N at the 3rd byte within the range from 0x00 to 0x5. Any other settings will not accept the command. The LSI looks ahead files in the number specified by N. ・ Since READ_PFILE_NAME allows you to specify in a range of 0 to N, you can obtain the information of up to N+1 files. ・ Initial setting is N=0x03 file prediction analysis.

SET_LBIT	4	0x60	0x0D	N	0x00	・ Set up LBIT and a copy bit when SPDIF output.
						・ Select N at the 3rd byte from the following. Any setting other than N=0x01 is considered to specify N=0x00.
						  N=0x00: SPDIF LBIT=1, copy bit = 0 (copy disabled).
						  N=0x01: SPDIF LBIT=0, copy bit = 1 (copy enabled).
						・ Initial value is N= 0x00, (ban on a copy).

SET_UTPKT	4	0x60	0x0F	N	0x00	・ Set up a USB terminal output.
						・ Select N at the 3rd byte from the following. Any other setting is considered to specify N=0x01.
						  N=0x00: Normally operating terminal
						  N=0x01: Outputs a test packet from the USB terminal.
						・ Initial value is N= 0x00.

GET_DEV_FREE	4	0x60	0x10	0x00	0x00	・ Analyze the availability of the media selected now. ・ The LSI starts analyzing the free space after receiving the command. During analysis, SEARCH=0x1 is set. Upon completion of analysis, SEARCH=0x0 is set. ・ After analyzing the free space, you can use the READ_DEV_FREE command to obtain the current free space. ・ The LSI does not monitor the free space automatically. Whenever changing the system operation mode or the selected media, you should

						restart analysis.
SET_LANG2	4	0x60	0x11	0x00	N	・Set up the character encoding conversion mode inside a file system. ・Please choose N from the following values. The other setup is not received. N= 0x00 : Character encoding conversion is performed inside a file system. N= 0x01 : Character encoding conversion is not performed inside a file system. ・When N= 0x01 is set up, an action changes as follows. the path information which Read(s) -- the data in media -- it becomes binary data as it is The other delimiter and reservation character of path information turns into a character of UTF-16 encoding. ・After a receptionist, when this command performs changes in system mode, it becomes effective. ・Please use it as N=0x00 when changing to the operation modes other than the PLAYER mode. ・An initial value is N= 0x00.
SET_OUTLANG	4	0x60	0x12	0x00	N	・Set up whether UTF8/UTF16 conversion is performed when the character string status output of a file and a folder name. ・Please choose N from the following values. The other setup is not received. N= 0x00 : With a setup of SET_LANG, it outputs without changing. N= 0x01 : It changes and outputs to UTF-8 at the time of an output. N= 0x02 : It changes and outputs to UTF-16 at the time of an output. ・An initial value is N= 0x00.
SET_TOUT_TUR	4	0x60	0x18	0x01	N	・Set up the wait time after Test Unit Ready command transmission at the time of USB memory recognition. ・When the response to Test Unit Ready is failure, re-try of Test Unit Ready is performed after the setting value Nx2 (msec). ・Re-try is performed to 375 times. ・A timeout occurs after the setting value Nx750 (msec). ・An initial value is 191sec (setting value N=0xFF).
SET_IDL_TIME	6	0x60	0x18	0x02	0x00	・Set up the idle time after USB memory bus reset. ・Set a setup as the 5 - 6th byte with a little endian. ・Setting value {6th=M, 5th=N} x0.167 (usec) becomes wait time. ・As for an initial value, 220usec (setting value N=1325= {M=x05, N=x2D}) is set up. ・Please set a setting value as the range of 300 (50usec)-9000 (1.5msec).
SET_TUR_PASS	4	0x60	0x18	0x0B	N	・Operation after timeout generating with the Test Unit Ready command is set up at the time of USB memory recognition. ・Please choose 4th byte N from the following. A setup of those other than the following operates as that to which 0x01 was set. N= 0x00: It is referred to as ERROR as memory recognition failure after a timeout. N= 0x01: When the number of effective LUN is one, after a timeout, the response of Test Unit Ready is disregarded and the next memory recognition processing is performed. ・An initial value is N= 0x00.
SET_THR1	12	0x6F	0x00	0x00	0x00	・Setup which performs the through output to I²S output from I²S input. ・Please set up 8 bytes from the 5th byte of following. 0x00 0x00 0x30 0xD0 0x1E 0x00 0x00 0x00 ・When you perform a through output, please set up SET_THR1, SET_THR2, and SET_THR3. ・When the operation mode was changed from the CD-DA mode and the START_ENCODE command are issued, this setting is released.

SET_THR2	12	0x6F	0x00	0x00	0x00	・Setup which performs the through output to I²S output from I²S input.
						・Please set up 8 bytes from the 5th byte of following.
						  Through output invalidity; 0x00 0x00 0xB0 0xD0 0x01 0x00 0x00 0x00
						  Through output effective; 0x00 0x00 0xB0 0xD0 0x05 0x00 0x00 0x00
						・When you perform a through output, please set up SET_THR1, SET_THR2, and SET_THR3.
						・When the operation mode was changed from the CD-DA mode and the START_ENCODE command are issued, this setting is released.

SET_THR3	12	0x6F	0x00	0x00	0x00	・Setup which performs the through output to I²S output from I²S input. ・Please set up 8 bytes from the 5th byte of following. 　EIAJ input; 0x00 0x00 0x40 0xE0　0x00 0x00 0x00 0x00 　I²S input; 0x00 0x00 0x40 0xE0　0x30 0x00 0x00 0x00 ・When you perform a through output, please set up SET_THR1, SET_THR2, and SET_THR3. ・When the operation mode was changed from the CD-DA mode and the START_ENCODE command are issued, this setting is released.
PLAY control						
PLAY	2	0x61	0x01	-	-	・When receiving the PLAY command during stop, the LSI starts playing the file currently selected. ・When receiving the PLAY command during pause, the LSI starts playing the file at the paused time.
PAUSE	2	0x61	0x02	-	-	・When receiving the PAUSE command during play, the LSI pauses playing of the file
HOME	4	0x61	0x03	N	0x00	・When receiving the HOME command, the LSI searches files of the first tune within the memory. ・TAG analysis, if it is enabled, is performed. ・It is not the first tune in the memory at the time of the random setup, but it is moved for the tune chosen at random. ・Select N at the 3rd byte from the following.　Any setting other than N=0x00 is considered to specify N=0x01. 　N=0x00: Stops after search is completed. 　N=0x01: Starts playing after search is completed.
PLAYMODE	4	0x61	0x04	N	0x00	・When receiving the PLAYMODE command, the LSI changes play mode in accordance with the setting of N in the 3rd byte. ・During stop, this command cannot start playing the file. ・Select N at the 3rd byte from the following. Any other settings will not accept the command. 　N=0x00: Changes to normal play. 　N=0x01: Changes to fast forward. 　N=0x02: Changes to rewind. ・Initial setting is N= 0x00. It is normal Playing.
VOL+	4	0x61	0x06	0x01	0x00	・When receiving the VOL+ command, the LSI controls the sound volume step by incrementing by 1. ・The sound volume is controlled in 32 steps from -∞ (minimum volume) to 0 dB (maximum volume).
VOL-	4	0x61	0x06	0x02	0x00	・When receiving the VOL- command, the LSI controls the volume step by decrementing by 1. ・The sound volume is controlled in 32 steps from -∞ (minimum volume) to 0 dB (maximum volume).
REPEAT	4	0x61	0x06	0x03	0x00	・This command changes the mode for repeat. ・REPEAT command toggles as: memory repeat ->1 music repeat -> folder repeat. ・For the settings of the REPEAT, RANDOM, and SET_REPRAND commands, the one finally set becomes enabled. ・Initial setting is the all-songs repeat in a memory.
RANDOM	4	0x61	0x06	0x04	0x00	・This command changes the mode for random play. ・If random play is enabled, the LSI plays the currently-played file at random in the area of ±128 files in the sort order. ・The RANDOM command toggles as: Normal play->Repeat all the tunes within the memory. ・For the settings of the REPEAT, RANDOM and SET_REPRAND commands, the one finally set becomes enabled.

FF	4	0x61	0x07	M	N	・When receiving the FF command during play, pause, or stop, the LSI searches the file N tunes ahead from the file being played or paused in the sort order. ・If the number of remaining files is less than N in the sort order, the LSI searches back to the first file. ・If N=0, the LSI searches the current file. ・If REPEAT or RANDOM is set, the LSI searches the next file in accordance with the setting. However, if "repeat 1 tune" is set, the LSI searches the next file in accordance with the repeat setting within the memory. ・If TAG analysis is enabled, the LSI also performs that analysis. ・After searching, the LSI operates in accordance with the setting in the 3rd byte. 　Select M at the 3rd byte from the following. Any setting other than M=0x00 is considered to specify M=0x01. 　M=0x00: Stops after search is completed. 　M=0x01: Starts playing after search is completed. ・The number of tunes to be searched depends on the setting of N in the 4th byte.
FB	4	0x61	0x08	M	N	・When receiving the FB command during play, pause, or stop, the LSI searches the file, N tunes back from the file being played, paused or stopped, in the sort order. ・When the LSI play is playing a tune in less than N files from the top in the sort order, it searches the first tune. However, only when the file to be searched is the first tune within the memory in the "repeat within the memory" setting, the LSI searches the file across the last tune within the memory to the first one. If the file to be searched is the first file within the folder in the "repeat within the folder" setting, the LSI searches the file within the same folder. ・If N=0, the LSI searches the top of the current file. However if it receives the FB command with N=0 when the play time is within 1 second, the LSI searches the top of the previous tune. ・If REPEAT or RANDOM is set, the LSI searches files in accordance with the setting. However, if "repeat one tune" is set, the LSI searches files in accordance with the "repeat within the memory" setting. ・If TAG analysis is enabled, the LSI also performs that analysis. ・After searching, the LSI operates in accordance with the setting in the 3rd byte. Select M at the 3rd byte from the following. Any setting other than M=0x00 is considered to specify M=0x01. 　M=0x00: Stops after search is completed. 　M=0x01: Starts playing after search is completed. ・The number of tunes to be searched depends on the setting of N in the 4th byte.
FOL+	4	0x61	0x09	M	N	・When receiving the FOL+ command during play, pause, or stop, the LSI searches the folder N tunes ahead from the one having the file being played, paused or stopped in the sort order. ・If the remaining folders are less than N in the sort order, the LSI returns to the first folder. ・Even if REPEAT or RANDOM is set, the LSI searches the file in the status where repeat mode is set. ・Search the file chosen at random when RANDOM is set. ・If N=0, the LSI searches the top of the current folder. ・If TAG analysis is enabled, the LSI also performs that analysis. ・After searching, the LSI operates in accordance with the setting in the 3rd byte. Select M at the 3rd byte from the following. Any setting other than M=0x00 is considered to specify M=0x01. 　M=0x00: Stops after search is completed. 　M=0x01: Starts playing after search is completed. ・The number of tunes to be searched depends on the setting of N in the 4th byte.

FOL-	4	0x61	0x0A	M	N	・When receiving the FOL- command during play, pause, or stop, the LSI searches the folder N tunes back from the one having the file being played or paused in the sort order. ・When playing a tune less than N folders from the top in the sort order, the LSI returns to the first folder.　However, when playing a file within the first folder, the LSI searches the folder across the last tune within the memory. ・Even if REPEAT or RANDOM is set, the LSI searches the file in the status where repeat mode is set. ・Search the file chosen at random when RANDOM is set. ・If N=0, the LSI searches the top of the current folder. ・If TAG analysis is enabled, the LSI also performs that analysis. ・After searching, the LSI operates in accordance with the setting in the 3rd byte.　Select M at the 3rd byte from the following.　Any setting other than M=0x00 is considered to specify M=0x01. M=0x00: Stops after search is completed. M=0x01: Starts playing after search is completed. ・The number of folders to be searched depends on the setting of N in the 4th byte.
PLAY_RESUME	46	0x61	0x0B	0x00	0x00	・This command sets 42-byte data obtained by the READ_RESUME_INFO command to 5th-46th bytes. ・Set the data in ascending order of the offsets obtained by the READ_RESUME_INFO command. ・After writing the command, the LSI starts resume play. ・If the resume target cannot be searched, the LSI searches the first tune of in the device and plays.
PLAY Setting						
SET_DOUT	4	0x61	0x10	0x00	N	・This command sets audio output. ・Select N at the 4th byte from the following.　Any other settings will not accept the command. N=0x00: Outputs via Audio line. N=0x01: Outputs using the SPDIF interface N=0x02: Outputs in I^{2}S (32fs) format. N=0x03: Outputs in I^{2}S (48fs) format. N=0x04: Outputs in I^{2}S (64fs) format. N=0x05: Outputs in EIAJ (32fs) format. N=0x06: Outputs in EIAJ (48fs) format. N=0x07: Outputs in EIAJ (64fs) format. ・By default, N=0x00: " Audio line output" is set.
SET_EQ	4	0x61	0x10	0x01	N	・This command sets the equalizer. ・Set N at the 4th byte from the following.　Any other settings will not accept the command. N=0x00: EQ OFF N=0x01: POPS N=0x02: JAZZ N=0x03: ROCK N=0x04: CLASSIC N=0x05: R&B N=0x07: EQ OFF N=0x08: BASS BOOST1 N=0x09: POPS + BASS BOOST1 N=0x0A: JAZZ + BASS BOOST1 N=0x0B: ROCK + BASS BOOST1 N=0x0C: CLASSIC + BASS BOOST1 N=0x0D: R&B + BASS BOOST1 N=0x0F: BASS BOOST2 ・By default, N=0x00: EQ OFF is set.
SET_VOL	4	0x61	0x10	0x02	N	・This command sets the sound volume with the value of N at the 4th byte in 32 steps from 0x00 to 0x1F. ・Setting range outside 0x00 to 0x1F will not accept the command. ・By default, N=0x06 is set.

| SET_NEXT | 4 | 0x61 | 0x10 | 0x03 | N | ・ This command sets next tune play mode.
・ Select N at the 4th byte from the following.　Any settings other than N=0x04 will not accept the command.
　N=0x00: PLAY_NEXT:
　　After the tune being played is completed, the LSI automatically searches the next tune and starts playing it.
　N=0x01: PLAY_ALL_STOP:
　　After the last tune within the memory being played is completed, the LSI reaches the next tune and stops.
　　When the play command is issued again, the LSI starts playing the next tune.
　N=0x02: PLAY_FOL_STOP:
　　After the last tune within the folder being played is completed, the LSI searches the next tune and stops.
　　When the play command is issued again, the LSI starts playing the next tune.
　N=0x03: PLAY_TUN_STOP:
　　After the tune being played is completed, the LSI searches the next tune and stops.
　　When the play command is issued again, the LSI starts playing the next tune.
・ By default, N=0x00 is set.
・ If the repeat mode is set to "repeat within folder", operation setting N=0x01 will become disabled.　The LSI searches the next tune and then starts playing it.
・If the repeat mode is set to "repeat one tune", operation settings N=0x01 and 0x02 will become disabled.　The LSI searches the next tune and then starts playing it.
・ If the repeat mode is set to "random within memory" or "random within folder", the operation settings N=0x01 and 0x02 will become disabled. The LSI searches the next tune and then starts playing it.
・ When system operation mode is PLAYLIST mode, operation in a folder of N= 0x02 setup becomes invalid, and does not receive a command. |
| SET_REPRAND | 4 | 0x61 | 0x10 | 0x04 | N | ・ This command sets repeat mode.
・ Select N at the 4th byte from the following.　Any other settings will not accept the command.
　N=0x00: REPEAT_ALL: Repeats within the memory
　　Repeats all the tunes within the memory being played.
　N=0x01: REPEAT_FOL: Repeats within the folder
　　Repeats the tunes within the folder being played.
　N=0x02: REPEAT_TUN: Repeats one tune
　　Repeats the tune being played.
　　A setup of the repeat in the memory is followed when FF and FB command.
　N=0x03: REPEAT_TUN: Repeats one tune
　　Repeats the tune being played.
　　A setup of the repeat in the memory is followed when FF and FB command.
　N=0x04: RANDOM_ALL: Random within the memory
　　Plays tunes at random starting from the one being played, in a range 128 tunes ahead and back of the tune.
　N=0x05: RANDOM_FOL: Random within the folder
　　Plays tunes at random within the folder starting from the one being played, in a range 128 tunes ahead and back of the tune.
・ By default, N=0x00 is set.
・ For the settings of the REPEAT, RANDOM and SET_REPRAND commands, the one finally set becomes enabled.
・ When system operation mode is PLAYLIST mode, operation in a folder of N= 0x01 and 0x05 setup becomes invalid, and does not receive a command. |

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SET_TAG	4	0x61	0x10	0x05	N	・This command sets TAG analysis mode. ・Select N at the 4th byte from the following.　Any settings other than N=0x00 will be considered to specify N=0x01. N=0x00: Does not perform TAG analysis. N=0x01: Performs TAG analysis. ・TAG analysis is performed immediately before the LSI starts playing a tune, and started from the file to be searched after the setting is enabled. ・After TAG analysis is completed, the LSI writes the result to the status register. ・By default, N=0x01: "Performs TAG analysis" is set.
SET_TOC	4	0x61	0x10	0x06	N	・This command sets TOC analysis mode. ・Select N at the 4th byte from the following.　Any setting other than N=0x00 will be considered to specify N=0x01. N=0x00: Does not perform TOC analysis. N=0x01: Performs TOC analysis. ・When receiving the command, inserting or changing the device, the LSI analyzes the total number of folders within the device (all the folders including root folders) and the total number of playable files.　When receiving a command, TOC analysis is performed only at change from OFF to ON. ・The total number of files conforms to the SEL_MP3 command. ・After TOC analysis is completed, the LSI writes the result to the status register, and stops at the first tune in the device. ・By default, N=0x00: "Does not perform TOC analysis" is set.
SET_PRM	8	0x61	0x10	0x07	L	・This command sets play time (M) and skip time (N) for fast forward and rewind. ・Play time is a period of time to make sound. Skip time is a period of time to skip during search. ・For fast forward and rewind, a cycle of {play time (M) + skip time (N) + error (O)} is repeated. 　The error is determined by the difference between the minimum decode unit and the rounding error between the play time and the real time requiring to search the skip time. The error varies depending on the file and memory structure. ・Play time is set to M[15:0]= [6th byte, 5th byte], and skip time to N[15:0]= [8th byte, 7th byte]. The unit is msec.　By default, play time is 300ms=M[15:0]= [6th byte=x01,5th byte=x2C], and skip time is 2100ms=N[15:0]= [8th byte=x08,7th byte=x34]. Specifying 0x0 sets the default. Set play time to 300ms or more, and skip time to (play time×16) or less. When it is moved by the fast rewind play in the front to the tune, the regenerated time of the first period may become shorter than setup time. ・0xL in the 4th byte sets the attenuation level during fast forward and rewind. The allowable level is -6dB X[4th byte]. Allowable setting range is from 0x00 to 0x10. By default, 0x02=-12dB is set.　Setting of 0x10 is equivalent to MUTE.
BROWSING						
ANALYZE_ROOT	4	0x62	0x00	0x00	0x00	・The LSI starts analyzing the root folder immediately after receiving the command. ・The analysis is performed for the information of the entries (files or subfolders) set by the SET_BROWSE_NUM command. ・Upon completion of analysis, the cursor position for browsing within the memory is set to the first entry (file or subfolder) within the root folder.
PLAY_CURSOR	4	0x62	0x01	0x00	0x00	・This command selects the file being pointed by the memory browsing cursor. ・If a playable file is selected, the LSI starts playing it. ・If a folder or unplayable file is selected, this command will not be accepted.
GET_TAG_CURSOR	4	0x62	0x01	0x01	0x00	・This command performs TAG analysis for the file being pointed by the memory browsing cursor. ・When a file is pointed by the memory browsing cursor, the LSI immediately starts TAG analysis through the file.　Upon completion of analysis, the LSI writes the result to the status register. ・When a folder is pointed by the memory browsing cursor, this command will not be accepted.

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GET_PATH_CUR SOR	4	0x62	0x01	0x03	0x00	・This command analyzes the full path (within the memory) of the entry pointed by the memory browsing cursor.
PLAY_DIRECT	10	0x62	0x01	0x04	0x00	・This command starts playing the file specified by the access data. ・If the access data does not specify a playable file, the LSI searches the first tune in the device and stops. ・The position of the memory browsing cursor does not change. ・Set the access data at the 5th-10th bytes. *2
MOV_NEXT	4	0x62	0x02	0x01	N	・This command moves the memory browsing cursor from the current position to the position N ahead in the sort order. ・The analysis is performed for the information of the entries specified by the SET_BROWSE_NUM command, starting from the move destination. After the analysis is completed, the LSI writes the result to the status register. ・If there are less than N files after the current memory browsing cursor position in the folder, the cursor position goes to the end of the folder. ・If the sort function (SET_SORT) is OFF, the cursor moves in the FAT order.
MOV_PREV	4	0x62	0x02	0x02	N	・This command moves the memory browsing cursor from the current position to the position N backward in the sort order. ・The analysis is performed for the information of the entries specified by the SET_BROWSE_NUM command, starting from the move destination. After the analysis is completed, the LSI writes the result to the status register. ・If there are less than N files from the top of the folder to the current memory browsing cursor position, the cursor position goes to the top of the folder. ・If the sort function (SET_SORT) is OFF, the cursor moves in the FAT order.
MOV_UP	4	0x62	0x02	0x03	0x00	・This command moves the memory browsing cursor to a higher-level folder. ・After moving, the LSI analyzes the folder. ・If the cursor is in the highest layer (root), nothing will be done.
MOV_DOWN	4	0x62	0x02	0x04	0x00	・This command selects the lower-level holder pointed by the memory browsing cursor to move. After moving, the LSI analyzes the folder. ・When a folder is selected, the LSI starts analyzing it. ・When a file is selected, the LSI does not accept the command. ・If the cursor selects the folder in the lowest layer, nothing will be done.
MOV_HOME	4	0x62	0x02	0x05	0x00	・This command moves the memory browsing cursor to the top of the root folder. ・After moving, the LSI analyzes the folder.
MOV_PLAYING	4	0x62	0x02	0x06	0x00	・This command moves the memory browsing cursor to the tune being played. ・After moving, the LSI analyzes the folder. ・During stop or search, the LSI does not accept the command.
MOV_DIRECT	10	0x62	0x02	0x07	N	・This command moves the memory browsing cursor to the position specified by the access data. ・After moving, the LSI starts analyzing at this position. ・Set the access data at the 5th-10th bytes. *2 ・Select the operation after moving with N in the 4th byte. Select N from the following. Any setting other than N=0x00 will be considered to specify N=0x01. N=0x00: Only moves the cursor and analyzes. N=0x01: If moving to a file, starts playing it.

SET_EXTENSION	4	0x62	0x04	0x00	N	・ This command sets the type of file to be output to the status register when browsing within the memory (analyzing the folder). ・ Select N at the 4th byte from the following. Any other settings will not accept the command. N=0x00: Playable file N=0x01: Play list file N=0x02: All files N=0x03: Folder only (Does not browsing files.) ・ The initial value depends on the mode. In PLAYER mode: N=0x00: Playable file In PLAYLIST mode: N=0x01: Play list file In FILE RW: N=0x02: All files In other cases: N=0x00: Playable file ・ The setting of this command is reflected only when the ANALYZE_ROOT command is executed. After setting the command again, be sure to execute the ANALYZE_ROOT command.
PLAYLIST						
SET_PLAYLIST	260	0x62	0x10	0x00	N	・ This command selects the play list file by full path and file name. ・ The file name is set at the 5th-260th bytes. *3 ・ The setting for MUSIC/playlist/playlist.m3u will be: x4D 55 53 49 43 5C 70 6C 61 79 6C 69 73 74 5C 70 6C 61 79 6C 69 73 74 2E 6D 33 75 00. ・ The operation after search conforms to the setting of N in the 4th byte. Select N from the following. Any setting other than N=0x00 will be considered to specify N=0x01. N=0x00: Searches the first tune and then stops. N=0x01: Searches the first tune and then starts playing it. ・ After executing this command, the position of the play list browsing cursor is reset to the top.
SET_PLAYLIST_DIRECT	10	0x62	0x11	0x00	N	・ This command selects a play list file by access data. ・ The LSI does nothing if the access data is other than play list file. ・ Set the access data at the 5th-10th bytes. *2 ・ The operation after search conforms to the setting of N in the 4th byte. Select N from the following. Any setting other than N=0x00 will be considered to specify N=0x01. N=0x00: Searches the first tune and then stops. N=0x01: Searches the first tune and then starts playing it. ・ After executing this command, the position of the play list browsing cursor is reset to the top.
SET_PLAYLIST_CURSOR	4	0x62	0x12	0x00	N	・ This command specifies the entry pointed by the play list browsing cursor as play list. ・ The LSI does nothing if a file other than the play list is specified. ・ The operation after search conforms to the setting of N in the 4th byte. Select N from the following. Any setting other than N=0x00 will be considered to specify N=0x01. N=0x00: Searches the first tune and then stops. N=0x01: Searches the first tune and then starts playing it. ・ After executing this command, the position of the play list browsing cursor is reset to the top. ・When the full path of the entry that the cursor indicates is larger than that of 256 bytes, Status1.ERROR becomes H.
PLST_PLAY_CURSOR	4	0x62	0x13	0x00	0x00	・ This command plays the file pointed by the play list browsing cursor. ・ If any play list is not selected, the command will not be accepted. ・When the full path of the entry that the cursor indicates is larger than that of 256 bytes, Status1.ERROR becomes H.
PLST_GET_TAG_CURSOR	4	0x62	0x13	0x01	0x00	・ This command starts TAG analysis for the file pointed by the play list browsing cursor. ・ If any play list is not selected, the command will not be accepted.
PLST_MOV_NEXT	4	0x62	0x14	0x00	N	・ This command moves the play list browsing cursor to the position N ahead from the current position. ・ The LSI analyzes the information as much as the files (or folders) set by the SET_BROWSE_NUM command. After analysis, the LSI writes the result to the status register. ・ If any play list is not selected, the command will not be accepted.

PLST_MOV_PREV	4	0x62	0x14	0x01	N	・This command moves the play list browsing cursor to the position N backward from the current position. ・The LSI analyzes the information as much as the files (or folders) set by the SET_BROWSE_NUM command.　After analysis, the LSI writes the result to the status register. ・If any play list is not selected, the command will not be accepted.
PLST_MOV_HOME	4	0x62	0x14	0x02	0x00	・This command moves the play list browsing cursor to the top. ・The LSI analyzes the information as much as the files (or folders) set by the SET_BROWSE_NUM command.　After analysis, the LSI writes the result to the status register. ・If any play list is not selected, the command will not be accepted.
PLST_MOV_PLAYING	4	0x62	0x14	0x03	0x00	・This command moves the play list browsing cursor to the tune being played. ・The LSI analyzes the information as much as the files (or folders) set by the SET_BROWSE_NUM command.　After analysis, the LSI writes the result to the status register. ・If any play list is not selected, the command will not be accepted.
FILE RW						
FOPEN_R	260	0x63	0x01	0x00	0x00	・This command specifies the full path and name of the file to be read from the memory using the File Read function. ・If a file exists after receiving the command, open the specified file. ・The file name is set at the 5th-260th bytes.　*3
FOPEN_R_CURSOR	4	0x63	0x01	0x01	0x00	・This command specifies the file pointed by the memory browsing cursor for the one to be read from the memory using the File Read function. ・If a file exists after receiving the command, open the specified file. ・When the full path of the entry that the cursor indicates is larger than that of 256 bytes, Status1.ERROR becomes H.
FOPEN_R_DIRECT	10	0x63	0x01	0x02	0x00	・This command specifies the access data of the file to be read from the memory using the File Read function. ・The access data is 6 bytes.　Set it at the 5th-10th bytes. *2 ・If a file exists after receiving the command, open the specified file.
FOPEN_W	266	0x63	0x02	0x00	0x00	・This command specifies the full path, name, and update date information of the file to be written to the memory using the File Write function. ・After receiving the command, open the specified file. ・You can set the update date information in terms of year, month, day and time. ・Set the update date information at the 5th-10th bytes in BCD format in the order of year (upper), year (lower), month, day, hour, and minute.　If all the data of the update date information is set to 0x00, the LSI considers that 0x20, 0x09, 0x01, 0x01, 0x12, and 0x00 are specified when processing the data. ・The file name is set at the 11th-266th bytes.　*3 ・If the specified file does not exist, it should be created. ・A file with the same name that already exists will be deleted. ・After creating a file, the structure of the file creation folder (including the intermediate folders) is changed.　Thus, when using the browsing function, you should start over browsing analysis by ANALYZE_ROOT.
FCLOSE	4	0x63	0x03	0x00	0x00	・This command closes the file. ・After the File Read/Write function is completed, CLOSE the file.

SET_FRW_BUS	4	0x63	0x04	N	M	・This command selects the BUS to be used with the File Read/Write function. When selecting the I²C bus, data of up to 256 bytes can be read/written at one transfer. When selecting the SPI bus, data up to 4 Kbytes can be read/written at one transfer. ・Set the BUS type to be used with N at the 3rd byte. Select N from the following. Any other settings will not accept the command. N=0x00: Uses the I²C bus. N=0x01: Uses the 8-bit SPI bus. N=0x02: Uses the 16-bit SPI bus. N=0x03: Uses the 32-bit SPI bus. ・Set a SPI mode with M at the 4th byte. Select M at the 4th byte from the following. If any other setting is specified, the LSI does nothing. If N=0x00, the following M values will become disabled. M=0x00: Uses SPI mode 0. M=0x01: Uses SPI mode 1. M=0x02: Uses SPI mode 2. M=0x03: Uses SPI mode 3. ・By default, N=0x00: "Uses the I²C bus" is set (M=0x00).
FWRITE_DAT	4/260	0x63	0x05	N	N	・This command specifies data size to be written and the data itself. ・At 0xN(16bit) in the 3rd and 4th bytes, specify the data size to be written at one transfer in Little Endian format. ・When using the I²C bus, set the data at the 5th-260th bytes. Data of up to 256 bytes can be sent at one time. ・When using the SPI bus, the LSI waits until the FWRREADY bit turns 1 after this command is sent, and then starts transferring the data through that bus. When the transferred data reaches the data size specified by SPI transfer, the LSI starts writing the data to the memory. Data of up to 4096 bytes can be sent at one time. ・If the specified data size does not match the data size actually sent, this command is assumed to be an error.
FREAD_DAT	6	0x63	0x06	N	N	・This command specifies the position of data to be read from the file at File Read. ・Specify the data position to be read in the 3rd to 6th bytes in Little Endian format. ・When using the I²C bus, send this command and then check that the FRDREADY bit turns 1. Then, send the READ_FR_DATA command. Data of up to 256 bytes can be read at one time. ・When using the SPI bus, send this command and then check that the FRDREADYA bit turns 1. Then, read the data from the SPI bus. Data of up to 4096 bytes can be read at one time.
FDEL	260	0x63	0x07	0x00	0x00	・This command deletes the file or folder specified by the full path. ・The file name is set at the 5th-260th bytes. *3 ・The command deletes a folder only when there is no file (or folder) in it. ・After deleting a file or folder, the structure of the folder where the deleted file (or folder) existed is changed. Thus, when using the browsing function, you should start over browsing analysis by ANALYZE_ROOT.
FDEL_CURSOR	4	0x63	0x07	0x01	0x00	・This function deletes the file or folder being pointed by the memory browsing cursor. ・The command deletes a folder only when there is no file in it. ・After deletion, the cursor positions at the top of the folder where the deleted file or folder existed. Then, the LSI analyzes the folder. ・When the full path of the entry that the cursor indicates is larger than that of 256 bytes, FIOERROR becomes H.
SET_CLRPATH_CUR	9	0x6F	0x00	0x00	0x00	・Please specify 0x4D 0x90 0x00 0x10 0x00 for 5byte to 9byte. ・The internal path get flag set by the FDEL_CURSOR command and the FOPEN_R_CURSOR command execution is cleared. ・Please send this command before the GET_PATH_CURSOR command send after FDEL_CURSOR command and FOPEN_R_CURSOR command send.

CD-DA						
START_ENCODE *1	261	0x64	0x01	0x00	0x00	· This command specifies the full path, name and update date information of the file to be written during encode, opens the file, and starts encoding. · After receiving the command and opening the file, the LSI brings the data into the internal buffer and soon starts encoding it sequentially. · Set the update date information at the 5th-10th bytes in BCD format in the order of year (upper), year (lower), month, day, hour, and minute. If all the data of the update date information is set to 0x00, the LSI considers that 0x20, 0x09, 0x01, 0x01, 0x12, and, 0x00 are specified when processing the data. · The file name is set at the 11th-261st bytes. *3 · If the external memory is set to "file write enabled", and the file name is not set (0x00), the LSI will not accept the command. · If any files having the same name exist, the LSI append a number (1, 2….) to the end of each file name. · By default, the file is not opened. The encode function is disabled.

STOP_ENCODE
 	
*1
	4	0x64	0x02	0x00	N	· This command terminates encoding and closes the file.
						· Select the operation for closing files at the 4th byte. Select N at the 4th byte from the following. Any other settings will not accept the command.
						  N=0x00: Leaves the file and closes it.
						  N=0x01: Deletes the file and closes it.
						· By default, N=0x00: "Leaves the file and closes it" is set.

SET_COMP_MODE
 	
*1
	4	0x64	0x03	0x00	N	· This command sets the 3 pair data comparison and connection function.
						· Select N at the 4th byte from the following. Any other settings will not accept the command.
						  N=0x00: Disables the 3 pair data comparison and connection function.
						  N=0x01: Enables the 3 pair data comparison and connection function.
						· After receiving the command with "enabled" setting, the LSI compares the data when the input data is valid, and brings the data into the internal buffer when the 3 pair data is matched.
						· After matching the data and starting fetching it into the internal buffer, the LSI disables the comparison and connection function.
						· When the command is set to "disabled", the LSI brings the input data into the internal buffer if it is valid.
						· By default, the comparison and connection function is disabled.

SET_ENCODE_MODE
 	
*1
	4	0x64	0x04	N	M	· This command sets the encode format and the play status during encode.
						· Set the encode format with N at the 3rd byte. Select N from the following. Any other settings will not accept the command.
						  N=0x00: Writes to MP3 external memory (USB, SD).
						  N=0x01: -(Not used)
						  N=0x02: Writes to WAV external memory (USB, SD).
						  N=0x03: -(Not used)
						· Set the play status during encode with M at the 4th byte. Select M at the 4th byte from the following. Any other settings will not accept the command.
						  M=0x00: Does not play.
						  M=0x01: - ,
						  M=0x02: -
						  M=0x03: Input through (Thins out pre-encoded input data internally by 44.1 kHz and outputs it to DAC.) The voice is not output while the comparison connection is operating.
						· By default, N=0x00: "Writes to MP3 external memory (USB,SD)", and M=0x00: "Does not play" are set.
						· Do this setting before opening the encode file (before START_ENCODE). Any change made after opening the file will not be accepted.

SET_ENCODE_PRM *1	8	0x64	0x05	N	M	· Set the format of the input from CD with N at the 3rd byte. Select N from the following. Any other settings will not accept the command. N=0x00: Inputs in I^{2}S (32 fs) format. N=0x01: Inputs in I^{2}S (48 fs) format. N=0x02: Inputs in I^{2}S (64 fs) format. N=0x04: Inputs in EIAJ (32 fs) format. N=0x05: Inputs in EIAJ (48 fs) format. N=0x06: Inputs in EIAJ (64 fs) format. · Set the sample rate of the input from CD with M at the 4th byte. Select M from the following. Any other settings will not accept the command. M=0x00: 32 kHz, M=0x01: 44.1 kHz, M=0x02: 48 kHz · Set the bit rate during MP3 encode with L at the 5th byte. Select L from the following. Any other settings will not accept the command. L=0x00: 32 kbps, L=0x01: 64 kbps, L=0x02: 128 kbps L=0x03: 192 kbps, L=0x04: 256 kbps, L=0x05: 320 kbps · By default, N=0x05: "EIAJ (48 fs)", M=0x01: "44.1 kHz", and L=0x02: "128 kbps" are set. · Do this setting before opening the encode file (before START_ENC). Any change after opening the file will not be accepted. · Embed 6th to 8th bytes with 0x00.
SET_ENCODE_TAG *1	68	0x64	0x06	N	M	· This command sets ID3 V2.3 TAG to be written during encode. · Up to 64 bytes of TAG can be written to TITLE, ARTIST, ALBUM, and GENRE. · Set the TAG type with N at the 3rd byte. Select N from the following. Any other settings will not accept the command. N=0x00: TITLE, N=0x01: ARTIST, N=0x02: ALBUM, N=0x03: GENRE · Set the TAG character code with M at the 4th byte. Select M from the following. Any other settings will not accept the command. M=0x00: ISO-8859-1 or no specification (Native [Shift-JIS etc.]) M=0x01: UTF-16 (Unicode with BOM) · When specifying M=0x01, BOM(U+FEFF) is required to identify Endian. · Set the data at the 5th-68th bytes in the left aligned format. If the data to be written is less than 64 bytes, embed the empty bytes with 0x00s. · Do this setting before opening the encode file (before START_ENCODE). Any change after opening the file will not be accepted. · When closing the file (STOP_ENCODE), this setting is cleared.
CD-ROM						
START_CDROM	4	0x65	0x00	N	M	· This command enables CD-ROM input. · Set the ECC retry count with N at the 3rd byte. Specify N within the range from 0x00 to 0x0F. Any other settings will not accept the command. · When N=0x00, error correction is performed only for EDC. When N=0x01 to 0x0F, the LSI executes EDC and then executes ECC as many times as specified (retry specification). · Set the format of the input from CD with M at the 4th byte. Select M from the following. Any other settings will not accept the command. M=0x00: Inputs in I^{2}S (32fs) format. M=0x01: Inputs in I^{2}S (48fs) format. M=0x02: Inputs in I^{2}S (64fs) format. M=0x04: Inputs in EIAJ (32fs) format. M=0x05: Inputs in EIAJ (48fs) format. M=0x06: Inputs in EIAJ (64fs) format. · By default, N=0x03: "ECC retry count 3" and M=0x05: "Inputs in EIAJ (48fs) format" are set. · By default, CD-ROM input is disabled.
STOP_CDROM	4	0x65	0x01	0x01	0x00	· This command disables CD-ROM input. · The command cancels the SEEK request (necessary LBN request). · When the LSI is analyzing the CD-ROM file system, the command stops analysis.

START_CDANA	4 or8	0x65	0x01	0x02	0x00	・ This command starts analyzing the CD-ROM file system. ・ After receiving the command, the LSI requests the necessary LBN. ・When the necessary LBN data is input, the LSI analyzes the data.　After analysis, it outputs the analyzed result to the status register. ・ If the command length is less than 8 bytes, the LSI searches the CD-ROM file system information starting from LBN=0. ・ To analyze the file system information after the 2nd session on the multi-session disk, you must specify the starting LBN.　In this case, specify the LBN in which the file system information resides (after the start position of this session) at the 5th-8th bytes in Little Endian format. ・ Reset the acquisition state of a file/folder information.
STOP_CDANA	4	0x65	0x01	0x03	0x00	・ This command stops or suspends analysis of the CD-ROM file system. ・ If the file system analysis is not completed, you can restart it.
CD_SET_VD	4	0x65	0x02	0x00	N	・ This command set Volume Descriptor, which is preferred during the CD-ROM file system analysis, at the 4th byte. ・ Select N at the 4th byte from the following. Any other settings will not accept the command. 　N=0x00: PVD preferred 　N=0x01: SVD preferred ・ By default, N=0x00: "PVD preferred" is set.
CD_SET_LBN	12-	0x65	0x03	0x00	N	・This command sets the information on the file to be played (first LBN, file size, file name and file kind). ・ Select N at the 4th byte from the following. Any other settings will not accept the command. 　N=0x01:MP3 , N=0x02:WMA 　Please specify the value read by the READ_CD_FILE command as it is. ・ Set the LBN data at the 5th-8th bytes in Little Endian format. ・ Set the size data at the 9th-12th bytes in Little Endian format. ・ Set the file name at the 13th and following bytes with NUL (0x00) at the end.　If the command length is less than 14 bytes, do not set the file name. In this case, the file name is obtained as a null character string with some commands such as READ_PFILE_NAME. ・ After receiving the command, the LSI requests necessary LBN. When the valid data is input, the LSI starts decoding the data. ・ When the playing of the file ends, the next tune is selected, and it becomes stop condition.

*1　BU94702AKV and BU94705AKV only.
*2　The access data must analyze the browsing, and use the acquired data.
　　Please analyze again when the exchange or the file of media is deleted,
　　and the file is written, and acquire the access data.
*3　The full path of file name is 256 bytes at maximum (including drive letter (A:¥), file name and extension) and less than 16 class. Please specify the full path in the language set by the SET_LANG command. Please set N=0x00 to the SET_LANG2 command.
　　If the length is less than 256 bytes, insert 0x00 at the end. Insert "¥"(0x5C) for the delimiter between folder layers. The drive letter is "A:¥" for USB and "B:¥" for SD. You can also specify the path in a format without drive letter. If the full path has a drive letter different from the one for the memory being selected, Status1.ERROR=H occurs. (For example, "B:¥" is set for the full path when USB is selected.)
　　The full path becomes 251 bytes or less when START_ENCODE command.

Table 32. Command enable/disable in each system operation mode

Command	Command enable/disable in each system operation mode							Command enable/disable in each status						
	CONFIG	PLAYER	FILE RW	PLAYLIST	IPL WRITE	CD-DA	CD-ROM	STOP	PLAY	SEARCH (mode)	SEARCH (file)	Analyze	Write	ERROR
CONFIG														
CHG_SYSTEM_MODE	○	○	○	○	○	○	○	○	○	×	×	×	×	○
STOP	○	○	○	○	○	○	○	○	○	○	○	○	○	○
ABORT	○	○	○	○	○	○	○	○	○	○	○	○	×	×
CHG_DEV	○	○	○	○	○	○	○	○	○	×	×	×	×	○

DIS_WDT	○	○	○	○	○	○	○	○	×	×	×	×	×	×
SET_WDT	○	○	○	○	○	○	○	○	×	×	×	×	×	○
SET_SORT	○	○	○	○	○	○	○	○	×	×	×	×	×	×
SET_12MOUT	○	○	○	○	○	○	○	○	×	×	×	×	×	○
SET_LANG	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_MP3	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_BROWSE_NUM	○	○	○	○	○	○	○	○	×	×	×	×	×	×
SET_PLAYINFO_NUM	○	○	○	○	○	○	○	○	×	×	×	×	×	×
SET_LBIT	○	○	○	○	○	○	○	○	×	×	×	×	×	○
SET_UTPKT	○	×	×	×	×	×	×	○	×	×	×	×	×	×
GET_DEV_FREE	○	○	○	○	○	○	○	○	×	×	×	×	×	×
SET_LANG2	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_OUTLANG	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_TOUT_TUR	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_IDL_TIME	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_TUR_PASS	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_THR1	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_THR2	○	×	×	×	×	×	×	○	×	×	×	×	×	×
SET_THR3	○	×	×	×	×	×	×	○	×	×	×	×	×	×
PLAY control														
PLAY	○	○	×	○	×	×	○	○	○	×	×	×	×	×
PAUSE	×	○	×	○	×	×	○	○	○	×	×	×	×	×
HOME	×	○	×	○	×	×	×	○	○	×	×	×	×	×
PLAYMODE	×	○	×	○	×	×	×	○	○	×	×	×	×	×
VOL+	○	○	○	○	○	○	○	○	○	×	×	×	×	○
VOL-	○	○	○	○	○	○	○	○	○	×	×	×	×	○
REPEAT	×	○	×	○	×	×	○	○	○	×	×	×	×	×
RANDOM	×	○	×	○	×	×	○	○	○	×	×	×	×	×
FF	×	○	×	○	×	×	○	○	○	×	×	×	×	×
FB	×	○	×	○	×	×	○	○	○	×	×	×	×	×
FOL+	×	○	×	×	×	×	○	○	○	×	×	×	×	×
FOL-	×	○	×	×	×	×	○	○	○	×	×	×	×	×
PLAY_RESUME	×	○	×	○	×	×	×	○	○	×	×	×	×	×
PLAY Setting														
SET_DOUT	○	○	○	○	○	○	○	○	○	×	×	×	×	○
SET_EQ	○	○	○	○	○	○	○	○	○	×	×	×	×	○
SET_VOL	○	○	○	○	○	○	○	○	○	×	×	×	×	○
SET_NEXT	×	○	×	○	×	×	○	○	○	×	×	×	×	×
SET_REPRAND	×	○	×	○	×	×	○	○	○	×	×	×	×	×
SET_TAG	×	○	×	○	×	×	○	○	○	×	×	×	×	×
SET_TOC	×	○	×	×	×	×	○	○	○	×	×	×	×	×
SET_PRM	×	○	×	○	×	×	○	○	○	×	×	×	×	×
BROWSING														
ANALYZE_ROOT	×	○	○	○	×	×	×	○	○	×	○	×	×	×
PLAY_CURSOR	×	○	×	×	×	×	×	○	○	×	×	×	×	×
GET_TAG_CURSOR	×	○	×	×	×	×	×	○	○	×	○	×	×	×
GET_PATH_CURSOR	×	○	○	○	×	×	×	○	○	×	○	×	×	×
PLAY_DIRECT	×	○	×	×	×	×	×	○	○	×	×	×	×	×
MOV_NEXT	×	○	○	○	×	×	×	○	○	×	○	×	×	×
MOV_PREV	×	○	○	○	×	×	×	○	○	×	○	×	×	×
MOV_UP	×	○	○	○	×	×	×	○	○	×	○	×	×	×
MOV_DOWN	×	○	○	○	×	×	×	○	○	×	○	×	×	×
MOV_HOME	×	○	○	○	×	×	×	○	○	×	○	×	×	×
MOV_PLAYING	×	○	×	×	×	×	×	×	○	×	×	×	×	×
MOV_DIRECT	×	○	×	○	×	×	×	○	○	×	○	×	×	×

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SET_EXTENSION	×	○	○	○	×	×	○	○	○	○	○	×	×	×
PLAYLIST														
SET_PLAYLIST	×	×	×	○	×	×	×	○	○	×	×	×	×	×
SET_PLAYLIST_DIRECT	×	×	×	○	×	×	×	○	○	×	×	×	×	×
SET_PLAYLIST_CURSOR	×	×	×	○	×	×	×	○	○	×	×	×	×	×
PLST_PLAY_CURSOR	×	×	×	○	×	×	×	○	○	×	×	×	×	×
PLST_GET_TAG_CURSOR	×	×	×	○	×	×	×	○	○	×	×	×	×	×
PLST_MOV_NEXT	×	×	×	○	×	×	×	○	○	×	×	×	×	×
PLST_MOV_PREV	×	×	×	○	×	×	×	○	○	×	×	×	×	×
PLST_MOV_HOME	×	×	×	○	×	×	×	○	○	×	×	×	×	×
PLST_MOV_PLAYING	×	×	×	○	×	×	×	○	○	×	×	×	×	×
FILE RW														
FOPEN_R	×	×	○	×	×	×	×	○	×	×	×	×	×	×
FOPEN_R_CURSOR	×	×	○	×	×	×	×	○	×	×	×	×	×	×
FOPEN_R_DIRECT	×	×	○	×	×	×	×	○	×	×	×	×	×	×
FOPEN_W	×	×	○	×	×	×	×	○	×	×	×	×	×	×
FCLOSE	×	×	○	×	×	×	×	○	×	×	×	×	×	×
SET_FRW_BUS	×	×	○	×	×	×	×	○	×	×	×	×	×	×
FWRITE_DAT	×	×	○	×	×	×	×	○	×	×	×	×	×	×
FREAD_DAT	×	×	○	×	×	×	×	○	×	×	×	×	×	×
FDEL	×	×	○	×	×	×	×	○	×	×	×	×	×	×
FDEL_CURSOR	×	×	○	×	×	×	×	○	×	×	×	×	×	×
SET_CLRPATH_CUR	×	×	○	×	×	×	×	○	×	×	×	×	×	×
CD-DA														
START_ENCODE *1	×	×	×	×	×	○	×	○	×	×	×	×	×	×
STOP_ENCODE *1	×	×	×	×	×	○	×	○	○	○	×	○	○	×
SET_COMP_MODE *1	×	×	×	×	×	○	×	×	○	×	×	×	×	×
SET_ENCODE_MODE *1	×	×	×	×	×	○	×	○	×	×	×	×	×	×
SET_ENCODE_PRM *1	×	×	×	×	×	○	×	○	×	×	×	×	×	×
SET_ENCODE_TAG *1	×	×	×	×	×	○	×	○	×	×	×	×	×	×
CD-ROM														
START_CDROM	×	×	×	×	×	×	○	○	×	×	×	×	×	×
STOP_CDROM	×	×	×	×	×	×	○	○	○	○	○	○	×	×
START_CDANA	×	×	×	×	×	×	○	○	○	×	×	×	×	×
STOP_CDANA	×	×	×	×	×	×	○	○	○	×	×	×	×	×
CD_SET_VD	×	×	×	×	×	×	○	○	×	×	×	×	×	×
CD_SET_LBN	×	×	×	×	×	×	○	○	○	×	×	×	×	×

○ = enable, × = disable
*1 BU94702AKV and BU94705AKV only.

26.2 Status output

The operation information, such as internal statuses, play time, folders, files and Tags, is output using an I²C interface.
The statuses shown in Table33 Status Register Map are output.
When reading status via I²C, the OFFSET position is automatically incremented after reading byte data.   However, by issuing the I²C start condition, the OFFSET position is reset to OFFSET specified by the previous command.
To read statuses, two methods are available: to specify OFFSET of the status register map and read any bytes continuously from the OFFSET position; and to read byte data by a command without specifying the OFFSET position. Table 34 shows the status output commands.
Byte data, when reading via I²C, is output in Little Endian format.
When read over OFFSET=0x140, OFFSET does not return to 0x00, therefore the read value turns into an unfixed value.

Table 33. Status Register Map

OFFSET	Status	bit7 (MSB)	bit6	bit5	bit4	bit3	bit2	bit1	bit0 (LSB)
0x00	STATUS1	ERROR	SEARCH		BUSY	MCHNG	STOP	PAUSE	PLAY
0x01	STATUS2	IRPTO	0	STOP_INFO		INIT_END	PRECOM	RES_ERR	DEC_ERR
0x02	STATUS3	USBINS	SDINS	USBFILE	SDFILE	MDEVUSB	MDEVSD	PDEVUSB	PDEVSD
0x03	STATUS4	SEL_TOC	TINFUSB	TINFSD	SET_TAG	ANA_TAG	TAGINFO		
0x04	STATUS5	0	SEL_USBSD	FBP	FFP	PLAYFILE			
0x05	STATUS6	PRECOMSTAT							
0x06	VOLINF	0	0	0	VOLINF				
0x07	DOUTINF	EQINF				DOUTINF			
0x08	PMODEINF	REPEATINF				SETNEXTINF			
0x09	SEL_MP3	0	0	0	0	WDT_RFLG	12MOUT	SET_SORT	SET_MP3
0x0A	PSEC	PSECH				PSECL			
0x0B	PMINL	PMINLH				PMINLL			
0x0C	PMINH	PMIHH				PMINHL			
0x0D	TSEC	TSECH				TSECL			
0x0E	TMINL	TMINLH				TMINLL			
0x0F	TMINH	TMINHH				TMINHL			
0x10	LANGL	LANGL							
0x11	LANGH	LANGH							
0x12	PFOLNL	PFOLNL							
0x13	PFOLNH	PFOLNH							
0x14	PFILENFLL	PFILENLL							
0x15	PFILENFLH	PFILENLH							
0x16	PFILENFHL	PFILENHL							
0x17	PFILENFHH	PFILENHH							
0x18	PFILENMLL	PFILENLL							
0x19	PFILENMLH	PFILENLH							
0x1A	PFILENMHL	PFILENHL							
0x1B	PFILENMHH	PFILENHH							
0x1C	TFOLMEML	TFOLMEML							
0x1D	TFOLMEMH	TFOLMEMH							
0x1E	TFILEMEMLL	TFILEMEMLL							
0x1F	TFILEMEMLH	TFILEMEMLH							
0x20	TFILEMEMHL	TFILEMEMHL							
0x21	TFILEMEMHH	TFILEMEMHH							
0x22	BROWSESTAT	ANA_ERR	0		GET_PATH_END	GET_TAG_END	GET_TAG_ID		ANA_CUR
0x23	NUMANAFOLLL	NUMANAFOLLL							
0x24	NUMANAFOLLH	NUMANAFOLLH							

Addr	Register	bit7	bit6	bit5	bit4	bit3	bit2	bit1	bit0
0x25	NUMANAFOLHL	NUMANAFOLHL							
0x26	NUMANAFOLHH	NUMANAFOLHH							
0x27	TFILEANAFOLL	TFILEANAFOLL							
0x28	TFILEANAFOLLH	TFILEANAFOLLH							
0x29	TFILEANAFOLHL	TFILEANAFOLHL							
0x2A	TFILEANAFOLHH	TFILEANAFOLHH							
0x2B	TFOLANAFOLL	TFOLANAFOLL							
0x2C	TFOLANAFOLH	TFOLANAFOLH							
0x2D	TFOLANAHEIRL	TFOLANAFOLL							
0x2E	PLISTPLAY	PLIST_GTAG_END	PLIST_TAG_EXIST	PLIST_BR_ERR	PLIST_BR_BSY	PLISTERR	0	PLISTOPEN	PLISTPLAY
0x2F	FIOSTAT	FIOERR	0	FIORW	FIOOPEN	FRDREADY	FWRREADY	FIOSEARCH	FIOMODE
0x30	FIOSET	FIOBUS		FIOSPIMD		FIOOPE			
0x31	IPLWMODE	0	0	IPLWMODEACT	IPLWMODEEND	IPLWEER	IPLWEXIST	IPLSERCH	IPLWMODE
0x32	ENCON	ENCERR	0	ENCEND	ENCCLOSE	MEMACC	ENC	ENCSEARCH	ENCON
0x33	COMPON	TAGW	ENCMP3	ENCMEMW	ENCMEM	0	COMPOPE2	COMPOPE1	COMPON
0x34	ENC_PLAY	ENC_INFORM				ENC_PLAY			
0x35	ENC_BITRATE	ENC_INSR				ENC_BITRATE			
0x36	CDROMON	0	0	SEEK	CDROMANAERR	CDROMANAEND		CDROMANABUSY	CDROMON
0x37	MEMINFO	MEMINFO				0	0	IRPTOINT	IRPTODEVICE
0x38 - 0x13F	COMAREA	COMAREA							

OFFSET	Status	bit	NAME	Contents
0x00	STATUS1	7	ERROR	ERROR situation 0 ; Nothing error, 1 ; Error
		6:5	SEARCH	SEARCH situation 0: Search stop, 1: Under a search (file search) , 2: Under a search (under device recognition)
		4	BUSY	BUSY situation 0: non-BUSY , 1:BUSY
		3	MCHNG	Music change detection 0: Under a music end / stop, 1: Stop after search/ Playing.
		2	STOP	STOP state 0: not stopped, 1: Under a stop
		1	PAUSE	PAUSE state 0: not stopped, 1: Under a stop
		0	PLAY	Playing state 0: not reproducing, 1: Under Playing
0x01	STATUS2	7	IRPTO	IRPTO interruption state 0: Nothing interruption, 1;interruption
		6	0	0
		5:4	STOP_INFO	Stop state detailed information 0: It is except during the stop/stop after device mount, 1: Stop pulled [music] out the head, 2: Error stop, 3: Stop by the RPT_OFF function
		3	INIT_END	The completion situation of initialization 0: Incomplete 1: When a program is normally loaded from FLASH completed and (set to 1 at the time of either of the followings) connected and a program is normally downloaded from the host who has connected
		2	PRECOM	The last command situation 0;Normal receptionist, 1;Abnormalities (un-receiving)
		1	RES_ERR	Resume error 0: With no error, 1: Error
		0	DEC_ERR	Decoding error 0: With no error, 1: Error

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0x02	STATUS3	7	USBINS	USB connection detection 0:USB un-connecting, 1:USB connection detection
		6	SDINS	SD connection detection 0:SD un-connecting, 1:SD connection detection
		5	USBFILE	Playable file existence in a USB memory 0;Nothing, 1;existence
		4	SDFILE	Playable file existence in a SD memory 0;Nothing, 1;existence
		3	MDEVUSB	USB memory recognition situation 0: Un-recognizing, 1: Recognition
		2	MDEVSD	SD memory recognition situation 0: Un-recognizing, 1: Recognition
		1	PDEVUSB	USB memory situation 0: Under a stop, 1: Under Playing/TAG analysis
		0	PDEVSD	SD memory situation 0: Under a stop, 1: Under Playing/TAG analysis
0x03	STATUS4	7	SEL_TOC	TOC analysis setup 0:TOC analysis OFF , 1:TOC analysis ON
		6	TINFUSB	Acquisition of total file/folder number in a USB memory. 0: Un-acquiring, 1: Finishing acquisition
		5	TINFSD	Acquisition of total file/folder number in a SD memory. 0: Un-acquiring, 1: Finishing acquisition
		4	SET_TAG	TAG analysis setup 0:TAG analysis OFF, 1:TAG analysis ON
		3	ANA_TAG	TAG analysis situation 0;TAG analysis stop, 1;Under TAG analysis
		2:0	TAGINFO	Existence TAG kind 0:ID 3V1, 1:ID 3V2, 2;With WMA, 3;AAC, 4;WAV, and 7: no TAG information
0x04	STATUS5	7	0	0
		6	SEL_USBSD	Device recognition priority situation 0:SD>USB 1:USB>SD
		5	FBP	Fast back Playing situation 0: normal Playing, 1:fast-back Playing
		4	FFP	Fast forward Playing situation 0: normal Playing, 1:fast-forward Playing
		3:0	PLAYFILE	Playing file information 1:MP3, 2:WMA, 3:AAC, 4:WAV
0x05	STATUS6	7:0	PRECOMSTAT	The last command receptionist situation detailed information; The last command outputs whether it received normally. A state is held to the following command. A state is not cleared by the lead command. The 0th bit is the same as that of PRECOM status. They are the contents at the time of abnormalities except it.
0x06	VOLINF	7:5	0	0
		4:0	VOLINF	Volume setting information. The value set up by SET_VOL [4:0] is outputted.
0x07	DOUTINF	7:4	EQINF	EQ setting information. The value set up by SET_EQ [3:0] is outputted.
		3:0	DOUTINF	Audio output setting information. The value set up by SET_DOUT [3:0] is outputted.
0x08	PMODEINF	7:4	REPEATINF	REPEAT MODE setting information. The value set up by SET_REPRAND [3:0] is outputted.
		3:0	SETNEXTINF	PLAY NEXT MODE setting information. The value set up by SET_NEXT [3:0] is outputted.
0x09	SEL_MP3	7	0	0
		6	0	0
		5	0	0
		4	0	0
		3	WDT_RFLG	Monitor register for WDT 0:after RESET
		2	12MOUT	12MHz clock output 0:OFF, 1:ON
		1	SET_SORT	file sorting functional setup 0;SORT function OFF, 1;SORT function effective
		0	SET_MP3	MP3 file Playing setup 0; Extensions mp1 and mp2, mp3 Playing, 1; Reproduce only extension mp3.
0x0A	PSEC	7:4	PSECH	Playing time second information [7:4] x 10 seconds
		3:0	PSECL	Playing time second information [3:0] x 1 second
0x0B	PMINL	7:4	PMINLH	Playing time minutes information [7:4] x 10 minutes
		3:0	PMINLL	Playing time minutes information [3:0] x 1 minute
0x0C	PMINH	7:4	PMINHH	Playing time minutes information [7:4] x 1000 minutes
		3:0	PMINHL	Playing time minutes information [3:0] x 100 minutes
0x0D	TSEC	7:4	TSECH	1 track time second information [7:4] x 10 seconds
		3:0	TSECL	1 track time second information [3:0] x 1 second
0x0E	TMINL	7:4	TMINLH	1 track time minutes information [7:4] x 10 minutes
		3:0	TMINLL	1 track time minutes information [3:0] x 1 minute
0x0F	TMINH	7:4	TMINHH	1 track time minutes information [7:4] x 1000 minutes
		3:0	TMINHL	1 track time minutes information [3:0] x 100 minutes

0x10	LANGL	7:0	LANGL	TAG character code information lower byte [7:0]
0x11	LANGH	7:0	LANGH	TAG character code information higher byte [15:8]
0x12	PFOLNL	7:0	PFOLNL	Playing folder number in memory. Lower byte [7:0] ROOT becomes No.1. A number is shaken in order of sorting.
0x13	PFOLNH	7:0	PFOLNH	Playing folder number in memory. Higher rank byte [15:8]
0x14	PFILENFLL	7:0	PFILENLL	Playing file number in the present folder. [15:0], lower byte [7:0], a number is shaken from No.1 in order of sorting.
0x15	PFILENFLH	7:0	PFILENLH	Playing file number in the present folder. [15:0], Higher rank byte [15:8]
0x16	PFILENFHL	7:0	PFILENHL	Playing file number in the present folder. [31:16], Low rank byte [23:16]
0x17	PFILENFHH	7:0	PFILENHH	Playing file number in the present folder. [31:16], Higher rank byte [31:24]
0x18	PFILENMLL	7:0	PFILENLL	Playing file number in the memory. [15:0] Low rank byte [7:0]
0x19	PFILENMLH	7:0	PFILENLH	Playing file number in the memory. [15:0] Higher rank byte [15:8]
0x1A	PFILENMHL	7:0	PFILENHL	Playing file number in the memory. [31:16] Low rank byte [23:16]
0x1B	PFILENMHH	7:0	PFILENHH	Playing file number in the memory. [31:16] Higher rank byte [31:24]
0x1C	TFOLMEML	7:0	TFOLMEML	The number of total folders in a memory.　low rank byte [7:0]
0x1D	TFOLMEMH	7:0	TFOLMEMH	The number of total folders in a memory.　higher rank byte [15:8]
0x1E	TFILEMEML L	7:0	TFILEMEMLL	The number of total files in memory. [15:0] low-rank byte [7:0]
0x1F	TFILEMEML H	7:0	TFILEMEMLH	The number of total files in memory. [15:0] higher-rank [15:8]
0x20	TFILEMEMH L	7:0	TFILEMEMHL	The number of total files in memory. [31:16] low-rank byte [23:16]
0x21	TFILEMEMH H	7:0	TFILEMEMHH	The number of total files in memory. [31:16] higher-rank byte [31:24]
0x22	BROWSESTAT	7	ANA_ERR	Browsing analysis Error　0: With no error　1: Error-generate in analysis.
		6	0	-
		5	GET_PATH_END	Cursor position folder path analysis situation 0;Under folder path un-analyzing/analysis, 1;Finishing of folder path analysis
		4	GET_TAG_END	Cursor position TAG analysis situation 0: Under TAG un-analyzing/analysis,　1: Finishing of TAG analysis
		3:1	GET_TAG_ID	Existence TAG kind 0:ID 3V1, 1:ID 3V2, 2;With WMA, 3;AAC, 4:WAV, and 7: no TAG information
		0	ANA_CUR	Cursor position entry analysis.　0;Analysis stop,　1;Under analysis
0x23	NUMANAFO LLL	7:0	NUMANAFOLLL	Cursor position number in a cursor existence folder [15:0] The entry number which the cursor within the folder in which low rank byte [7:0] cursor exists has pointed out is outputted. A number is shaken from No.1 in order of sorting in a folder.
0x24	NUMANAFO LLH	7:0	NUMANAFOLLH	Cursor position number in a cursor existence folder [15:0] Higher rank byte [15:8]
0x25	NUMANAFO LHL	7:0	NUMANAFOLHL	Cursor position number in a cursor existence folder [31:16] Low rank byte [23:16]
0x26	NUMANAFO LHH	7:0	NUMANAFOLHH	Cursor position number in a cursor existence folder [31:16] Higher rank byte [31:24]
0x27	TFILEANAF OLLL	7:0	TFILEANAFOLLL	The number of files total in a cursor existence folder [15:0] Low rank byte [7:0]
0x28	TFILEANAF OLLH	7:0	TFILEANAFOLLH	The number of files total in a cursor existence folder [15:0] Higher rank byte [15:8]
0x29	TFILEANAF OLHL	7:0	TFILEANAFOLHL	The number of files total in a cursor existence folder [31:16] Low rank byte [23:16]
0x2A	TFILEANAF OLHH	7:0	TFILEANAFOLHH	The number of files total in a cursor existence folder [31:16] Higher rank byte [31:24]
0x2B	TFOLANAF OLL	7:0	TFOLANAFOLL	The number of subfolders total in a cursor existence folder [15:0] Low rank byte [7:0]
0x2C	TFOLANAF OLH	7:0	TFOLANAFOLH	The number of subfolders total in a cursor existence folder [15:0] Higher rank byte [15:8]
0x2D	TFOLANAH EIRL	7:0	TFOLANAHEIRL	The class's number of cursor existence folder [7:0] A ROOT class is set to 1.
0x2E	PLISTPLAY	7	PLIST_GTAG_EN D	TAG analysis situation on Browsing cursor position in Play LIST 0: Under TAG un-analyzing / analysis , 1:End of TAG analysis
		6	PLIST_TAG_EXIS T	TAG existence situation on Browsing cursor position in Play LIST 0: With no TAG, 1: with TAG
		5	PLIST_BR_ERR	Browsing error situation in Play LIST.　0: Normal end　1: Error

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		4	PLIST_BR_BSY	Browsing BUSY situation in Play LIST　0:Not-BUSY, 1:BUSY (under analysis)
		3	PLISTERR	Situation support to Play LIST.　0: With no error, 1: format Error.
		2	0	0
		1	PLISTOPEN	PLAY LIST file setting situation.　0;Un-setting up, 1;Play List setuped
		0	PLISTPLAY	PLAY LIST MODE effective/invalid.　0: invalid, 1 :P LAY LIST MODE is effective
0x2F	FIOSTAT	7	FIOERR	FILE IO Error situation　　0: With no Error,　1:Error
		6	0	0
		5	FIORW	FILE IO Read/Write mode　　0:Read mode, 1:Write mode
		4	FIOOPEN	FILE OPEN state　　0: Un-open　1;during file open
		3	FRDREADY	Read-out FIFO preparation situation　0:Under preparation, 1:Preparation O.K.
		2	FWRREADY	Write-in FIFO preparation situation　0:Under preparation, 1:Preparation O.K. (it is used only at the time of SPI bus use)
		1	FIOSEARCH	FILE IO processing situation　　0:Processing stop, 1:Under processing
		0	FIOMODE	FILE IO mode effective/invalid　0;invalid　　1; effective
0x30	FIOSET	7:6	FIOBUS	FILE IO use BUS kind setup.　0: I²C, 1:SPI (8 bits), 2:SPI (16 bits), 2:SPI (32 bits)
		5:4	FIOSPIMD	FILE IO SPI mode setup. 0:SPI MODE0, 1:SPI MODE1, 2:SPI MODE2, 3:SPI MODE3
		3:0	FIOOPE	The contents situation of FILE IO processing 0;With no processing , 1;OPEN, 2;Read, 3;Write, 4;Close, 5;Delete
0x31	IPLWMODE	7	0	0
		6	0	0
		5	IPLWMODEACT	IPL FLASH ROM rewriting operation situation. 0;Stop, 1;Under operation
		4	IPLWMODEEND	IPL FLASH ROM rewriting processing end situation. 0;during operation, 1;End
		3	IPLWEERR	IPL FLASH ROM Write Error Situation.　0;With no Error, 1;Write Error
		2	IPLWEXIST	File existence situation for rewriting in a memory. 0;With no file, 1;with a file
		1	IPLSERCH	File search situation for rewriting in a memory. 0;Search stop, 1;Under search
		0	IPLWMODE	IPL FLASH ROM rewriting mode effective/invalid　0;invalid, 1,effective
0x32	ENCON *1	7	ENCERR	Encode Error situation　　0;With no Error , 1;Error
		6	0	0
		5	ENCEND	Encoding end situation.　0;not ended, 1;File closed and finished
		4	ENCCLOSE	File Close operation situation　0;Stop, 1;Under Close operation
		3	MEMACC	External memory write-in situation　　0;Stop, 1;Under writing
		2	ENC	Encoding operation situation　　0;Stop, 1;Under encoding operation
		1	ENCSEARCH	Encoding preparation situation　0;Under preparation, 1;Preparation O.K. (data input possible state)
		0	ENCON	Encoding mode effective/invalid　　0;invalid , 1; effective
0x33	COMPON *1	7	TAGW	TAG write-in setting when encoding.　0: Nothing　　1:TAG write-in ON
		6	ENCMP3	Encoding format setup　　　0;WAV, 1;MP3
		5	ENCMEMW	External memory write-in setup on encoding. 0;invalid, 1; memory writing effective
		4	ENCMEM	The present external memory selection situation　　0:SD, 1:USB
		3	0	0
		2	COMPOPE2	Comparison connection operation result situation 0;Un-connecting, 1;Finishing [connection]
		1	COMPOPE1	Comparison connection operation situation　　0;Stop, 1;Under comparison
		0	COMPON	Comparison connection mode effective/invalid　0;invalid, 1;effective
0x34	ENC_PLAY *1	7:4	ENC_INFORM	Input format setup from CD　　SET_ENCODE_PRM (3rd byte)
		3:0	ENC_PLAY	Playing situation at the time of encoding.　0;With no Playing , 3;Input through　　SET_ENCODE_MODE
0x35	ENC_BITRA TE *1	7:4	ENC_INSR	Input sample rate setup　　SET_ENCODE_PRM (4th byte)
		3:0	ENC_BITRATE	Bit rate setup when MP3 encoding.　　SET_ENCODE_PRM (5th byte)
0x36	CDROMON	7	0	0
		6	0	0
		5	SEEK	CD-ROM function SEEK demand situation. 0;Nothing, 1;SEEK request
		4	CDROMANAERR	CD-ROM file analysis error situation　0;no Error, 1: with Error
		3:2	CDROMANAEND	CD-ROM file analysis end situation　0;Un-analyzing,　2: Analysis end
		1	CDROMANABUSY	CD-ROM file analysis situation　　　0;Stop, 1;Under analysis

		0	CDROMON	CD-ROM mode effective/invalid 0;invalid , 1;effective
0x37	MEMINFO	7:4	MEMINFO	Memory device information chosen now
		3	0	0
		2	0	0
		1	IRPTOINT	Interrupt packet existence flag 0;Nothing, 1;with a packet
		0	IRPTODEVICE	Device with two or more Config(s) 0:Config singular number, 1:Config plurality
0x38 - 0x13F	COMAREA	7:0	COMAREA	Data common area The contents change with status read-out commands. (When read-out exceeding OFFSET=0x140 is performed, OFFSET does not return to 0x00, but the value read becomes unfixed)

*1 BU94702AKV and BU94705AKV only.

Table 34. Status Output Commands

Command name	Command Byte length	Command				Status number of output bytes	STATUS
		1st	2nd	3rd	4th		
READ_BUFF	4	0x6C	0x00	N	M	Arbitrary	・Output the arbitrary number data of bytes from the OFFSET position where the status register map was specified. ・OFFSET is 3rd and 4th byte. It is specified as a byte by Little Endian (M, N= 0x00, 0x00 to 0x01, 0xFF).
READ_STATUS	4	0x6D	0x00	0x00	0x00	6	・Output about internal status. ・Output about OFFSET 0x00-0x05 of a status buffer.
READ_PSET	4	0x6D	0x00	0x01	0x00	4	・Output about setting information. ・Output about OFFSET 0x06-0x09 of a status buffer.
READ_PTIME	4	0x6D	0x00	0x02	0x00	6	・Output about Playing time information. ・Output about OFFSET 0x0A-0x0F of a status buffer. ・The playing time that can be acquired when the MP3 file playing might shift at the fast-forwarding, the rewinding, and the VBR playing. The change in time might be not constant the playing time that can be acquired when the low bit rate file playing.
READ_LANG	4	0x6D	0x00	0x02	0x01	2	・Output about TAG character code information. ・Output about OFFSET 0x10-0x11 of a status buffer.
READ_PNUM	4	0x6D	0x00	0x02	0x02	10	・Output about the number under Playing. ・Output about OFFSET 0x12-0x1B of a status buffer. ・An exact value of file and folder number in the memory cannot be acquired when music is specified by cursor or access data, such as a PLAY_CURSOR command.
READ_TNUM	4	0x6D	0x00	0x02	0x03	6	・Output about the file in a memory, and the number of folders. ・Output about OFFSET 0x1C-0x21 of a status buffer. ・It becomes 0 excluding PLAYER MODE.
READ_FNUM	4	0x6D	0x00	0x02	0x04	4	・Output the number of files which is in a folder during the present Playing.
READ_PFILE_NAME	4	0x6D	0x00	0x03	N	130	・Output the file name of the file of the +Nth file during the present Playing. ・Specify N from 0x00 to SET_PLAYINFO_NUM setting value. N=0x00 is the present file. Any other settings will not accept the command. ・Output is enabled only when the Nth file is within the same folder where the one being played resides. If the Nth file is in a different folder, "0" is output ・Output data has the prepositive data ID (2 bytes). *2
READ_PFOL_NAME	4	0x6D	0x00	0x04	0x00	130	・Output the folder name of the file being played. ・Output data has the prepositive data ID (2 bytes). *2
READ_PFILE_TAG	4	0x6D	0x00	0x05	N	130	・Outputs the data which is written to TAG of the file being played. ・Specify TAG type with 0xN at the 4th bytes. Select N at the 4th byte from the following. Any other settings will not accept the command. N=0x00: TITLE , N=0x01: ARTIST , N=0x02: ALBUM , N=0x03: GENRE ・Output data has the prepositive data ID (2 bytes). *2
READ_RESUME_INFO	4	0x6D	0x00	0x06	0x00	42	・Outputs the data required to execute resume play. ・The data is output in Little Endian format.

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READ_DEV_FREE	4	0x6D	0x00	0x07	N	8	・Outputs the free space analysis results of the file analyzed by the GET_DEV_FREE command. ・Specify the space type to be output with N at the 4th byte.　Select N at the 4th byte from the following.　Any other settings will be considered to specify N=0x01. 　N=0x00: Outputs the free space of the selected media by the byte. 　N=0x01: Outputs the TOTAL space of the selected media by the byte. ・If the GET_DEV_FREE command has not been sent, this command outputs "0".
READ_DEVDESC	4	0x6D	0x00	0x08	0x00	18	・Output a Device Descripter value when the USB memory is inserted and chosen.
READ_CONDESC	4	0x6D	0x00	0x08	0x01	32	・Output a Configration Descripter value when the USB memory has been recognized.
READ_INQUIRY	4	0x6D	0x00	0x08	0x02	36	・Output a MSC Inquiry value when the USB memory has been recognized.
READ_BROWSE_STATUS	4	0x6D	0x01	0x00	0x00	1	・Output about the browsing analysis status in a memory. ・Output about OFFSET 0x22- of a status buffer.
READ_BROWSE_PNUM	4	0x6D	0x01	0x00	0x01	4	・Output about the cursor position number of browsing in a memory. ・Output about OFFSET 0x23-0x26 of a status buffer.
READ_BORWSE_TNUM	4	0x6D	0x01	0x00	0x02	7	・Output about the number of entries in the folder in which the cursor of browsing in a memory exists, and the number of classes. ・Output about OFFSET 0x27-0x2D of a status buffer.
READ_BROWSE_FOL_INFO	4	0x6D	0x01	0x01	0x00	76	・Outputs the information on the folder where the entry being pointed by the memory browsing cursor resides. *3
READ_BROWSE_ENTRY_INFO	4	0x6D	0x01	0x02	N	76	・Outputs the information on the Nth entry ahead from the one being pointed by the memory browsing cursor. ・Specify N at the 4th byte. Specify N from 0x00 to SET_BROWSE_NUM setting value. N=0x00 is the present file. Any other settings will not accept the command. *3
READ_BROWSE_TAG	4	0x6D	0x01	0x03	N	130	・Outputs the TAG analysis results of the file analyzed by the GET_TAG_CURSOR command. ・Specify the TAG type with N at the 4th byte. ・Select N at the 4th byte from the following. Any other settings will not accept the command. 　N=0x00: TITLE,　N=0x01: ARTIST, 　N=0x02: ALBUM,　N=0x03: GENRE ・Output data has the prepositive data ID (2 bytes). *3
READ_BROWSE_PATH	4	0x6D	0x01	0x04	0x00	258	・Outputs the full path (including drive letter (A:\)) of the entry pointed by the cursor analyzed by the GET_PATH_CURSOR command. ・The drive letter is "A:\" for USB and "B:\" for SD. ・Output data has the prepositive data ID (2 bytes). *3
READ_PLIST_STATUS	4	0x6D	0x02	0x00	0x00	1	・Output about play list mode status. ・Output about OFFSET 0 x2E-x31 of a status buffer.
READ_PLIST_TAG	4	0x6D	0x02	0x01	N	130	・Outputs the TAG analysis results of the file analyzed by the PLST_GET_TAG_CURSOR command. ・Specify the TAG type with N at the 4th byte. Select N at the 4th byte from the following. Any other settings will not accept the command. 　N=0x00: TITLE,　　　N=0x01: ARTIST, 　N=0x02: ALBUM,　　N=0x03: GENRE ・Output data has the prepositive data ID (2 bytes). *3
READ_PLIST_PATH	4	0x6D	0x02	0x02	N	258	・Outputs the full path (including drive letter (A:\)) of the Nth entry ahead from the one pointed by the play list browsing cursor. ・The drive letter is "A:\" for USB and "B:\" for SD. ・Output data has the prepositive data ID (2 bytes). *3 ・Specify N at the 4th byte. Specify N in the range from 0x00 to 0x13 ("0x00" indicates the current entry).
READ_PLIST_NAME	4	0x6D	0x02	0x03	N	130	・Outputs the name of the Nth file ahead from the entry pointed by the play list browsing cursor. ・Output data has the prepositive data ID (2 bytes). *3 ・Specify N at the 4th byte. Specify N in the range from 0x00 to 0x13 ("0x00" indicates the current entry).

READ_PLIST_PLAY_PATH	4	0x6D	0x02	0x04	N	258	・Outputs the full path (including drive letter (A:\)) of the Nth entry ahead from the one being played. ・The drive letter is "A:\" for USB and "B:\" for SD. ・Output data has the prepositive data ID (2 bytes). *3 ・Specify N at the 4th byte. Specify N in the range from 0x00 to 0x04 (0x00 indicates the current entry).
READ_PLIST_PLAY_NAME	4	0x6D	0x02	0x05	N	130	・Outputs the name of the Nth file ahead from the entry being played. ・Output data has the prepositive data ID (2 bytes). *3 ・Specify N at the 4th byte. Specify N in the range from 0x00 to 0x04 (0x00 indicates the current entry).
READ_PLIST_TNUM	4	0x6D	0x02	0x06	0x00	4	・Outputs the currently set number of files within the play list.
READ_PLIST_PNUM	4	0x6D	0x02	0x07	0x00	4	・Outputs the currently set cursor position within the play list.
READ_FR_STATUS	4	0x6D	0x03	0x00	0x00	2	・Output about a file read and file write functional status. ・Output about OFFSET 0 x2F-0x30 of a status buffer.
READ_FR_SIZE	4	0x6D	0x03	0x01	0x00	4	・Output the file size of the file specified by the file read function. ・A unit is a byte. It outputs by LittleEndian.
READ_FR_DATA	4	0x6D	0x03	0x02	0x00	260	・Reads the data of the file specified by the File Read function. ・Up to 256 bytes of data can be read at one time. ・The leading 4 bytes are file offset. They are output in Little Endian format.
READ_IPL_STATUS	4	0x6D	0x05	0x00	0x00	1	・Output about IPL Write status. ・Output about OFFSET 0x31-x34 of a status buffer.
READ_ENC_STATUS *1	4	0x6D	0x06	0x00	0x00	4	・Output about Encode mode status. ・Output about OFFSET 0x32-0x35 of a status buffer.
READ_ENC_FILEPATH *1	4	0x6D	0x06	0x01	0x00	258	・Outputs the full path (including driver letter (A:\)) of the file during encode or previously encoded. ・The drive letter is "A:\" for USB and "B:\" for SD.
READ_CD_STATUS	4	0x6D	0x07	0x00	0x00	1	・Output about CD-ROM mode status. ・Output about OFFSET 0x36 of a status buffer.
READ_CD_SLBN	4	0x6D	0x07	0x01	0x00	4	・Output about the LBN number demanded by SEEK request. ・Output by LittleEndian.
READ_CD_PLBN	4	0x6D	0x07	0x01	0x01	4	・Output about the LBN number of the present input data. ・Output by LittleEndian.
READ_CD_FINUM	4	0x6D	0x07	0x01	0x02	6	・Outputs the number of files in the file system analysis result. ・Outputs the value in Little Endian format. ・1st-2nd byte : the file information acquirable number of a file system analysis result (n). The file information to this number can be read at 'READ_CD_FILE'. ・3rd-4th byte : The file number (m) of the head which can carry out information acquisition is outputted. ・5th-6th byte :The total file number of a file system analysis result is outputted. When analysis is not completed, the number of files which analysis has ended is outputted.
READ_CD_FONUM	4	0x6D	0x07	0x01	0x03	6	・Outputs the number of folders in the file system analysis result. ・Outputs the value in Little Endian format. ・1st-2nd byte : the folder information acquirable number of a file system analysis result (n). The folder information to this number can be read at 'READ_CD_FOL'. ・3rd-4th byte : The folder number (n) of the head which can carry out information acquisition is outputted. ・5th-6th byte :The total folder number of a file system analysis result is outputted. When analysis is not completed, the number of folders which analysis has ended is outputted.
READ_CD_FILE	4	0x6D	0x08	N	M	64	・Outputs information of the L[15:0]={M, N}th file in the file system analysis result. (For L, Please set up L between file information acquirable numbers [1st-2nd byte of 'REDA_CD_FINUM'] from 1.) ・The information is output in Little Endian format. ・When file system analysis is not completed, the maximum of specified L is recorded as information read-out completion. The acquired information may become invalid when analysis is resumed.

READ_CD_FOL	4	0x6D	0x09	N	M	64	·Outputs information of the L[15:0]={M, N}th folder in the file system analysis result. (For L, Please set up L between file information acquirable numbers [1st-2nd byte of 'REDA_CD_FONUM'] from 1.) · The information is output in Little Endian format. · If L=0 is specified, the command outputs the information on CD volume. · When file system analysis is not completed, the maximum of specified L is recorded as information read-out completion. The acquired information may become invalid when analysis is resumed.
READ_SYSMODE	4	0x6D	0x0A	0x00	0x00	1	· Output about the present system operation mode.
READ_MEMINFO	4	0x6D	0x0A	0x02	0x00	1	· Output about the present memory information. · Output about OFFSET 0x37 of a status buffer.
READ_CKSUM	4	0x6D	0x0A	0x03	0x00	5	· Output the CHECK SUM calculation result when IPL download. · Output a 1st byte= comparison result. When the 1st byte is 0x0, it shows that comparison result is coincidence. When the 1st byte is 0x1, it shows that comparison result is disagreement. · Output a 2nd-3th byte are calculation result and 3th-5th byte are the value currently written in FLASH ROM.
READ_MOUNT_ERROR	4	0x6D	0x0A	0x04	0x00	14	· Output the information on which stage of media mount went wrong when ERROR generating. · 1st byte: The state when USB enumeration is outputted. · 2nd byte: The state when SD initialization is outputted. · 10th byte: The state when file system analysis is outputted. · Other bytes should be disregarded. · Please read this value only when ERROR=1. · Also at the time, although a value is read, it is usually the information on ERROR=0 for which the value was performed at the end. · Please refer to process information about the details of a read-out value at the time of a back clause media mount error.
READ_BFULLO	10	0x6D	0xFE	0x00	0x00	1	· 5th-10th byte = it is 0x04 00 A0 D0 0x04 00 is specified. · Outputted 1 byte the 5th bit becomes BFULLO status.
READ_STOPST1	10	0x6D	0xFE	0x00	0x00	2	· 5th-10th byte = it is 0x2E 0x8F 0x00 0x10 0x02 0x00 is specified. · Outputted internal stop status.
READ_STOPST2	10	0x6D	0xFE	0x00	0x00	1	· 5th-10th byte = Please refer to the application note. · Outputted internal stop status.
READ_MEMORY1	10	0x6D	0xFE	0x00	0x00	4	· 5th-10th byte = it is 0x08 0x69 0x00 0x10 0x04 0x00 is specified. · Outputted internal FFP status.
READ_SDWP	10	0x6D	0xFE	0x00	0x00	1	· 5th-10th byte = it is 0x04 0x02 0xA0 0xD0 0x04 0x00 is specified. · Bit0 of the reading value outputs the state of the terminal WP of the SD card.
READ_FW_VER	4	0x6D	0xFF	0x00	0x00	4	· Output about a firmware version.
READ_IPL_VER	4	0x6D	0xFF	0x01	0x00	12	· Output about the image version in Flash. · 1st-2nd byte= model number, 3th-4th= year (lower 2 figures), 5th-8th= manufacture days and months, and 9th-12th="FLAS"=0x46 0x4C0x41 0x53 is outputted.

*1 BU94702AKV and BU94705AKV only.
*2 See 15.6 for the output format.
*3 See 16 for the output format.

Table 35. Command enable/disable in each system operation mode

Command	Command enable/disable in each system operation mode							Command enable/disable in each status						
	CONFIG	PLAYER	FILE RW	PLAYLIST	IPL WRITE	CD-DA	CD-ROM	STOP	PLAY	SEARCH (device)	SEARCH (FILE)	Analyze	Write	ERROR
READ_BUFF	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_STATUS	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_PSET	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_PTIME	○	○	○	○	○	○	○	○	○	×	×	×	×	×
READ_LANG	○	○	○	○	○	○	○	○	○	×	×	×	×	×

READ_PNUM	○	○	○	○	○	○	○	○	○	×	×	×	×	×
READ_TNUM	○	○	○	○	○	○	○	○	○	×	×	×	×	×
READ_FNUM	×	○	×	×	×	×	○	○	○	×	×	×	×	×
READ_PFILE_NAME	×	○	×	×	×	×	○	○	○	×	×	×	×	×
READ_PFOL_NAME	×	○	×	×	×	×	○	○	○	×	×	×	×	×
READ_PFILE_TAG	×	○	×	○	×	×	○	○	○	×	×	×	×	×
READ_RESUME_INFO	×	○	×	○	×	×	×	○	○	×	×	×	×	×
READ_DEV_FREE	○	○	○	○	○	○	○	○	×	×	×	×	×	×
READ_DEVDESC	○	○	○	○	○	○	○	○	×	×	×	×	×	×
READ_CONDESC	○	○	○	○	○	○	○	○	×	×	×	×	×	×
READ_INQUIRY	○	○	○	○	○	○	○	○	×	×	×	×	×	×
READ_BROWSE_STATUS	×	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_BROWSE_PNUM	×	○	○	○	×	×	×	○	○	×	×	×	×	×
READ_BORWSE_TNUM	×	○	○	○	×	×	×	○	○	×	×	×	×	×
READ_BROWSE_FOL_INFO	×	○	○	○	×	×	×	○	○	×	×	×	×	×
READ_BROWSE_ENTRY_INFO	×	○	○	○	×	×	×	○	○	×	×	×	×	×
READ_BROWSE_TAG	×	○	○	×	×	×	×	○	○	×	×	×	×	×
READ_BROWSE_PATH	×	○	○	○	×	×	×	○	○	×	×	×	×	×
READ_PLIST_STATUS	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_PLIST_TAG	×	×	×	○	×	×	×	○	○	×	×	×	×	×
READ_PLIST_PATH	×	×	×	○	×	×	×	○	○	×	×	×	×	×
READ_PLIST_NAME	×	×	×	○	×	×	×	○	○	×	×	×	×	×
READ_PLIST_PLAY_PATH	×	×	×	○	×	×	×	×	○	×	×	×	×	×
READ_PLIST_PLAY_NAME	×	×	×	○	×	×	×	×	○	×	×	×	×	×
READ_PLIST_TNUM	×	×	×	○	×	×	×	○	○	×	×	×	×	×
READ_PLIST_PNUM	×	×	×	○	×	×	×	○	○	×	×	×	×	×
READ_FR_STATUS	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_FR_SIZE	×	×	○	×	×	×	×	○	×	×	×	×	×	×
READ_FR_DATA	×	×	○	×	×	×	×	○	×	×	×	×	×	×
READ_IPL_STATUS	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_ENC_STATUS *1	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_ENC_FILEPATH *1	×	×	×	×	×	○	×	○	○	×	×	×	○	×
READ_CD_STATUS	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_CD_SLBN	×	×	×	×	×	×	○	○	○	×	×	×	×	×
READ_CD_PLBN	×	×	×	×	×	×	○	○	○	×	×	×	×	×
READ_CD_FINUM	×	×	×	×	×	×	○	○	○	×	×	×		
READ_CD_FONUM	×	×	×	×	×	×	○	○	○	×	×	×	×	×
READ_CD_FILE	×	×	×	×	×	×	○	○	○	×	×	×	×	×
READ_CD_FOL	×	×	×	×	×	×	○	○	○	×	×	×	×	×

READ_SYSMODE	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_MEMINFO	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_CKSUM	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_MOUNT_ERROR	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_BFULLO	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_STOPST1	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_STOPST2	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_MEMORY1	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_SDWP	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_FW_VER	○	○	○	○	○	○	○	○	○	○	○	○	○	○
READ_IPL_VER	○	○	○	○	○	○	○	○	○	○	○	○	○	○

○ = enable, ✕ = disable
*1 BU94702AKV and BU94705AKV only.

●**Notes for use**

1) Power on Reset
Please keep the terminal RESETX at the Low level when the power supply starts. After completely starting up 3.3V system power supply, afterwards, please make the terminal RESETX High level after 100us after the oscillation of the system clock is steady. Moreover, please make the terminal RESETX Low level during 100us or more when resetting it while operating.

2) About compatibility in USB memory device and SD memory card
According to the file structure and communication speed of an USB memory, SD memory card, this LSI might not play back correctly.

3) About turning on the power supply
Current rush might flow momentarily by the order of turning on the power supply and the delay in IC with two or more power supplies, and note the capacity of the power supply coupling, the power supply, and width and drawing the GND pattern wiring.

4) About absolute maximum rating
When the absolute maximum rating such as the applied voltage and the ranges of the operating temperature is exceeded, LSI might be destroyed. Please apply neither voltage nor the temperature that exceeds the absolute maximum rating. Please execute physical measures for safety such as fuse when it is thought to exceed the absolute maximum rating, and examine it so that the condition to exceed the absolute maximum rating is not applied to LSI.

5) About GND Voltage
In any state of operation must be the lowest voltage about the voltage of the terminal GND. Please actually confirm the voltage of each terminal is not a voltage that is lower than the terminal GND including excessive phenomenon.

6) About design of overheating malfunction preventive circuit
Please design overheating malfunction preventive circuit with an enough margin in consideration of a permissible loss in the state of using actually.

7) About the short between terminals and the mounting by mistake
Please note the direction and the gap of position of LSI enough about LSI when you mount on the substrate. LSI might be destroyed when mounting by mistake and energizing. Moreover, LSI might be destroyed when short-circuited by entering of the foreign substances between the terminal and GND, between terminals, between the terminal and the power supply of LSI.

8) About operation in strong electromagnetic field
Use in strong electromagnetic field has the possibility of malfunctioning and evaluate it enough, please.

9) About recording
Recording to a memory with slow access speed may require data connection operation.
Recording to all the memories cannot be guaranteed.

10) Power off or memory disconnection under memory writing
The sudden power off or memory disconnection during recording or file write operation to a memory may break the data in a memory.

11) Browsing operation
With a memory with slow access speed, Browsing operation during music playing may generate skipping.

12) CD-ROM playing
CD-ROM playing operation is premised on data being inputted so that an internal data buffer may not become empty.
When an input does not meet the deadline and internal data buffers become empty, skipping occurs.

13) Playing time of MP3 file
The playing time when MP3 file playing may shift when fast forward playing, rewinding playing, and VBR playing.

14) Write-in operation exceeding memory size
When memory size is exceeded, IC will stop writing to a file and will be in an error condition.

15) Write-in operation of the file size exceeding FAT specification
When file size is exceeded, IC will stop writing to a file and will be in an error condition.

16) About WMA
Windows Media Audio is the music compression technology which Microsoft Corp. developed.
Windows Media is the registered trademark of U.S. Microsoft Corporation in the U.S., and other countries.

17) About I^{2}C format I/F
Although this LSI has adopted the I^{2}C format, the level shifter circuit is not built in.
For this reason, level shifter is needed for connection with the device besides the range of operating power supply voltage of this LSI.

18) About " Made for iPod / iPhone / iPad License "
For using of BU94607AKV / BU94705AKV, It is necessary to become a licensee of Apple Inc. regarding "Made for iPod/iPhone/iPad License"
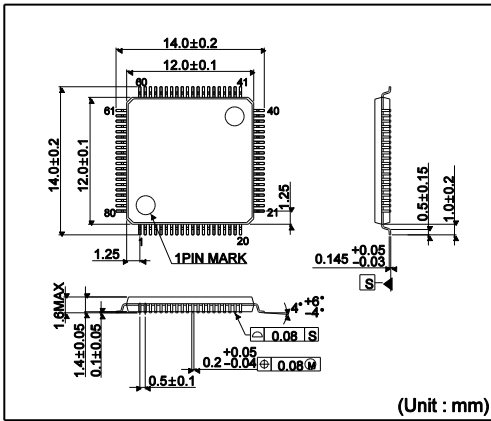
Status of this document
The Japanese version of this document is the formal specification. A customer may use this translation version only for a reference.
To help reading the formal version. If there are any differences in translation version of this document, formal version takes priority.

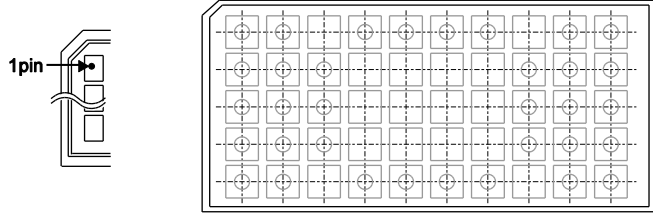●**Information about ordering part number**

B	U	9	4	x	0	x	A	K	V	-	E	2

Part Number
BU94605A
  (iPod not support, MP3 encode not support)
BU94607A(iPod support, MP3 encode not support)
BU94702A (iPod not support, MP3 encode support)
BU94705A(iPod support, MP3 encode support)

Package
KV: VQFP80

Packaging and forming specification
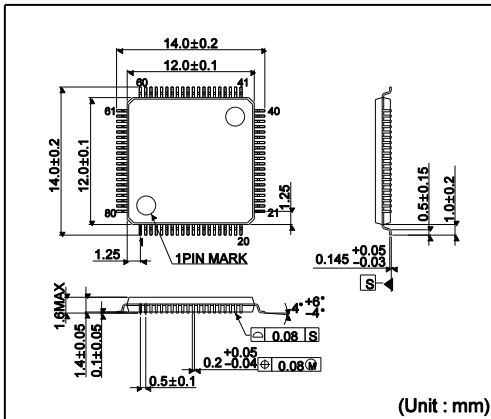E2: Reel-formed emboss taping
None: Tray, Tube

VQFP80

14.0±0.2
12.0±0.1
14.0±0.2
12.0±0.1
1.25
1.25
1PIN MARK
0.145 +0.05 −0.03
S
1.8MAX
1.4±0.05
0.1±0.05
0.5±0.1
4° +6° −4°
0.08 S
0.2 +0.05 −0.04
0.08 M
0.5±0.15
1.0±0.2
60 41
61
40
80
21
1
20
(Unit : mm)

<Tape and Reel information>

Container	Tray (with dry pack)
Quantity	1000pcs
Direction of feed	Direction of product is fixed in a tray

1pin

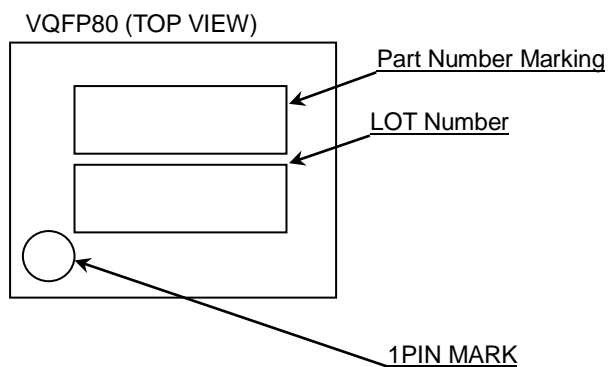∗Order quantity needs to be multiple of the minimum quantity.

VQFP80

14.0±0.2
12.0±0.1
14.0±0.2
12.0±0.1
1.25
1.25
1PIN MARK
0.145 +0.05 −0.03
S
1.8MAX
1.4±0.05
0.1±0.05
0.5±0.1
4° +6° −4°
0.08 S
0.2 +0.05 −0.04
0.08 M
0.5±0.15
1.0±0.2
60 41
61
40
80
21
1
20
(Unit : mm)

<Tape and Reel information>

Tape	Embossed carrier tape (with dry pack)
Quantity	1000pcs
Direction of feed	E2 (The direction is the 1pin of product is at the upper left when you hold reel on the left hand and you pull out the tape on the right hand)
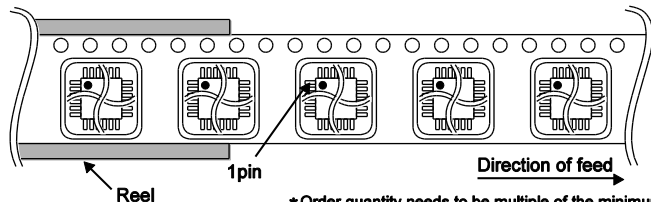
Reel   1pin   Direction of feed

∗Order quantity needs to be multiple of the minimum quantity.

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TSZ22111・15・001
     78/80
TSZ02201-0V2V0E600090-1-2
19.Mar.2019 Rev.003

●**Mark name image**

VQFP80 (TOP VIEW)

Part Number Marking

LOT Number

1PIN MARK

Part number	Part Number Marking	Ordering part number
BU94605AKV	BU94605AKV	BU94605AKV -E2 BU94605AKV
BU94607AKV	BU94607AKV	BU94607AKV -E2 BU94607AKV
BU94702AKV	BU94702AKV	BU94702AKV -E2 BU94702AKV
BU94705AKV	BU94705AKV	BU94705AKV -E2 BU94705AKV

●**Revision history**

Date	Revision	Changes
30.Aug.2012	001	New Release
10.Dec.2012	002	P.1 : A note is added to Feature P.9 : A note is added to 3. CD input interface P.49 : ABOT command option (TAG analysis) is deleted P.52 : Explanation addition of the HOME command in the random setup P.53 : Explanation addition of the FOL+ command in the random setup P.54 : Explanation addition of the FOL- command in the random setup P.56 : Explanation addition of the SET_PRM command at fast rewind play
19.Mar.2019	003	P.3 : Modified iPod support

19.Mar.2019 Rev.003

Notice

Precaution on using ROHM Products

1. Our Products are designed and manufactured for application in ordinary electronic equipment (such as AV equipment, OA equipment, telecommunication equipment, home electronic appliances, amusement equipment, etc.). If you intend to use our Products in devices requiring extremely high reliability (such as medical equipment [(Note 1)], transport equipment, traffic equipment, aircraft/spacecraft, nuclear power controllers, fuel controllers, car equipment including car accessories, safety devices, etc.) and whose malfunction or failure may cause loss of human life, bodily injury or serious damage to property ("Specific Applications"), please consult with the ROHM sales representative in advance. Unless otherwise agreed in writing by ROHM in advance, ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of any ROHM's Products for Specific Applications.

(Note1) Medical Equipment Classification of the Specific Applications

JAPAN	USA	EU	CHINA
CLASSⅢ	CLASSⅢ	CLASSⅡb	CLASSⅢ
CLASSⅣ		CLASSⅢ	

2. ROHM designs and manufactures its Products subject to strict quality control system. However, semiconductor products can fail or malfunction at a certain rate. Please be sure to implement, at your own responsibilities, adequate safety measures including but not limited to fail-safe design against the physical injury, damage to any property, which a failure or malfunction of our Products may cause. The following are examples of safety measures:
    [a] Installation of protection circuits or other protective devices to improve system safety
    [b] Installation of redundant circuits to reduce the impact of single or multiple circuit failure

3. Our Products are designed and manufactured for use under standard conditions and not under any special or extraordinary environments or conditions, as exemplified below. Accordingly, ROHM shall not be in any way responsible or liable for any damages, expenses or losses arising from the use of any ROHM's Products under any special or extraordinary environments or conditions. If you intend to use our Products under any special or extraordinary environments or conditions (as exemplified below), your independent verification and confirmation of product performance, reliability, etc, prior to use, must be necessary:
    [a] Use of our Products in any types of liquid, including water, oils, chemicals, and organic solvents
    [b] Use of our Products outdoors or in places where the Products are exposed to direct sunlight or dust
    [c] Use of our Products in places where the Products are exposed to sea wind or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
    [d] Use of our Products in places where the Products are exposed to static electricity or electromagnetic waves
    [e] Use of our Products in proximity to heat-producing components, plastic cords, or other flammable items
    [f] Sealing or coating our Products with resin or other coating materials
    [g] Use of our Products without cleaning residue of flux (Exclude cases where no-clean type fluxes is used. However, recommend sufficiently about the residue.) ; or Washing our Products by using water or water-soluble cleaning agents for cleaning residue after soldering
    [h] Use of the Products in places subject to dew condensation

4. The Products are not subject to radiation-proof design.

5. Please verify and confirm characteristics of the final or mounted products in using the Products.

6. In particular, if a transient load (a large amount of load applied in a short period of time, such as pulse, is applied, confirmation of performance characteristics after on-board mounting is strongly recommended. Avoid applying power exceeding normal rated power; exceeding the power rating under steady-state loading condition may negatively affect product performance and reliability.

7. De-rate Power Dissipation depending on ambient temperature. When used in sealed area, confirm that it is the use in the range that does not exceed the maximum junction temperature.

8. Confirm that operation temperature is within the specified range described in the product specification.

9. ROHM shall not be in any way responsible or liable for failure induced under deviant condition from what is defined in this document.

Precaution for Mounting / Circuit board design

1. When a highly active halogenous (chlorine, bromine, etc.) flux is used, the residue of flux may negatively affect product performance and reliability.

2. In principle, the reflow soldering method must be used on a surface-mount products, the flow soldering method must be used on a through hole mount products. If the flow soldering method is preferred on a surface-mount products, please consult with the ROHM representative in advance.

For details, please refer to ROHM Mounting specification

Precautions Regarding Application Examples and External Circuits

1. If change is made to the constant of an external circuit, please allow a sufficient margin considering variations of the characteristics of the Products and external components, including transient characteristics, as well as static characteristics.

2. You agree that application notes, reference designs, and associated data and information contained in this document are presented only as guidance for Products use. Therefore, in case you use such information, you are solely responsible for it and you must exercise your own independent verification and judgment in the use of such information contained in this document. ROHM shall not be in any way responsible or liable for any damages, expenses or losses incurred by you or third parties arising from the use of such information.

Precaution for Electrostatic

This Product is electrostatic sensitive product, which may be damaged due to electrostatic discharge. Please take proper caution in your manufacturing process and storage so that voltage exceeding the Products maximum rating will not be applied to Products. Please take special care under dry condition (e.g. Grounding of human body / equipment / solder iron, isolation from charged objects, setting of Ionizer, friction prevention and temperature / humidity control).

Precaution for Storage / Transportation

1. Product performance and soldered connections may deteriorate if the Products are stored in the places where:
    [a] the Products are exposed to sea winds or corrosive gases, including Cl_2, H_2S, NH_3, SO_2, and NO_2
    [b] the temperature or humidity exceeds those recommended by ROHM
    [c] the Products are exposed to direct sunshine or condensation
    [d] the Products are exposed to high Electrostatic

2. Even under ROHM recommended storage condition, solderability of products out of recommended storage time period may be degraded. It is strongly recommended to confirm solderability before using Products of which storage time is exceeding the recommended storage time period.

3. Store / transport cartons in the correct direction, which is indicated on a carton with a symbol. Otherwise bent leads may occur due to excessive stress applied when dropping of a carton.

4. Use Products within the specified time after opening a humidity barrier bag. Baking is required before using Products of which storage time is exceeding the recommended storage time period.

Precaution for Product Label

A two-dimensional barcode printed on ROHM Products label is for ROHM's internal use only.

Precaution for Disposition

When disposing Products please dispose them properly using an authorized industry waste company.

Precaution for Foreign Exchange and Foreign Trade act

Since concerned goods might be fallen under listed items of export control prescribed by Foreign exchange and Foreign trade act, please consult with ROHM in case of export.

Precaution Regarding Intellectual Property Rights

1. All information and data including but not limited to application example contained in this document is for reference only. ROHM does not warrant that foregoing information or data will not infringe any intellectual property rights or any other rights of any third party regarding such information or data.

2. ROHM shall not have any obligations where the claims, actions or demands arising from the combination of the Products with other articles such as components, circuits, systems or external equipment (including software).

3. No license, expressly or implied, is granted hereby under any intellectual property rights or other rights of ROHM or any third parties with respect to the Products or the information contained in this document. Provided, however, that ROHM will not assert its intellectual property rights or other rights against you or your customers to the extent necessary to manufacture or sell products containing the Products, subject to the terms and conditions herein.

Other Precaution

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2. The Products may not be disassembled, converted, modified, reproduced or otherwise changed without prior written consent of ROHM.

3. In no event shall you use in any way whatsoever the Products and the related technical information contained in the Products or this document for any military purposes, including but not limited to, the development of mass-destruction weapons.

4. The proper names of companies or products described in this document are trademarks or registered trademarks of ROHM, its affiliated companies or third parties.

General Precaution

1. Before you use our Products, you are requested to carefully read this document and fully understand its contents. ROHM shall not be in any way responsible or liable for failure, malfunction or accident arising from the use of any ROHM's Products against warning, caution or note contained in this document.

2. All information contained in this document is current as of the issuing date and subject to change without any prior notice. Before purchasing or using ROHM's Products, please confirm the latest information with a ROHM sales representative.

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