



USB Audio Decoder ICs

AAC/WMA/MP3+SDMemory Card +CD-ROM+MP3 Record



BU94702AKV

No.12080EBT06

•Description

BU94702AKV is 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

- 1) USB2.0 Full Speed host I/F function contained.
- 2) SD card I/F function contained.
- 3) I²C format I/F function contained.
- 4) MP3 encode function contained. (available for MPEG1, Layer3, support up to 2X input speed)
- 5) MP3 decode function contained. (available for MPEG1, 2 and 2.5, Layer 1, 2 and 3)
- 6) WMA decode function contained. (available for WMA9 standard and not available for DRM)
- 7) AAC decode function contained. (available for MPEG4 AAC-LC and not available for DRM)
- 8) WAV format file playing function contained.
- 9) Sample Rate Converter contained.
- 10) System Controller contained.
- 11) FAT analysis function contained.
- 12) CD-ROM I/F function and CD-ROM decode function contained.
- 13) Browsing function of other File Names, Folder Names on music playing contained.
- 14) ID3TAG and WMATAG and AACTAG Analysis.
- 15) Fast forward playing and fast backward playing function contained.
- 16) External processor can control. (SLAVE MODE)
- 17) Resume function contained.
- 18) Audio DAC contained.
- 19) Sound Effect function contained.
- 20) Digital Audio Out(I²S, EIAJ, S/PDIF) function contained.
- 21) Digital Audio Input(I²S, EIAJ) function contained.
- 22) Program download function from external serial Flash ROM contained.
- 23) Regulator for internal CORE power supply contained.
- 24) VQFP80pin(0.5mm pitch)

•Applications

Audio products, etc.

●Absolute maximum ratings (Ta = 25°C)

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

*1 : In the case of use at Ta=25°C or more, 7.5mW should be reduced per 1°C.
Radiation resistance design is not arranged.

●Operating conditions (Ta = 25°C)

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

1. Electrical characteristics

(Unless specified, Ta=25°C, 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 | - | 60 | 90 | mA | *1 When USB memory is played. |
| Circuit current (VDD1 SD1) | IDD1SD1 | - | 35 | 60 | mA | *1 When SD card is played. |
| <Digital block> | | | | | | |
| H-Level input voltage | VIH | VDD1*0.7 | — | VDD1 | V | *3 |
| L-Level input voltage | VIL | DVSS | — | VDD1*0.3 | V | *3 |
| H-Level output voltage1 | VOH1 | VDD1-0.4 | — | VDD1 | V | IOH=-1.6mA, *4 |
| L-Level output voltage1 | VOL1 | 0 | — | 0.4 | V | IOL=1.6mA, *4 |
| L-Level output voltage2 | VOL2 | 0 | — | 0.4 | V | IOL=3.6mA, *5 |
| H-Level output voltage3 | VOH3 | VDD1-0.4 | — | VDD1 | V | IOH=-0.6mA, *6 |
| L-Level output voltage3 | VOL3 | 0 | — | 0.4 | V | IOL=0.6mA, *6 |
| H-Level output voltage4 | VOH4 | VDD1-1.0 | — | VDD1 | V | IOH=-0.6mA, *7 |
| L-Level output voltage4 | VOL4 | 0 | — | 1.0 | V | IOL=0.6mA, *7 |
| <USB-HOST > | | | | | | |
| H-Level input voltage | VIHUSB | VDD1*0.6 | — | VDD1 | V | *8 |
| L-Level input voltage | VILUSB | AVSSC | — | VDD1*0.3 | V | *8 |
| Output impedance(H) | ZOH | 22.0 | 45.0 | 60.0 | Ω | *8 |
| Output impedance(L) | ZOL | 22.0 | 45.0 | 60.0 | Ω | *8 |
| H-Level output voltage | VOHUSB | VDD1-0.5 | — | VDD1 | V | *8 |
| L-Level output voltage | VOLUSB | 0 | — | 0.3 | V | *8 |
| Rise/Fall time | Tr/Tf | — | 11 | — | ns | *8, Output capacity 50pF |
| Voltage of crossing point | VCRS | — | VDD1/2 | — | V | *8, Output capacity 50pF |
| Range of differential input | VDIFF | 0.8 | — | 2.5 | V | *8 |
| Differential input sensitivity | VSENS | 0.2 | — | — | V | *8 |
| Pull-down resistance | RPD | 14.25 | 20.0 | 24.8 | kΩ | *8 |
| <Audio DAC> | | | | | | |
| Distortion rate | THD | — | 0.005 | — | % | 1kHz, 0dB, sine, output no-load *9 |
| Dynamic range | DR | — | 90 | — | dB | 1kHz, -60dB, sine, output no-load *9 |
| S/N ratio | S/N | — | 95 | — | dB | output no-load *9 |
| Max output level | VSMAX | — | 0.67 | — | Vrms | 1kHz, 0dB, sine, output no-load *9 |

*1 3.3V system I/O, Analog Power supply (VDD1), 1kHz, 0dB, sine-wave playing

*3 1, 3, 4-9, 14-23, 29, 31-32, 34-35, 61-63, 71-76 pin

*4 9, 11-12, 14-15, 18-20, 30, 36, 58-60, 61-67, 69-70 pin

*5 2, 3, 17 pin

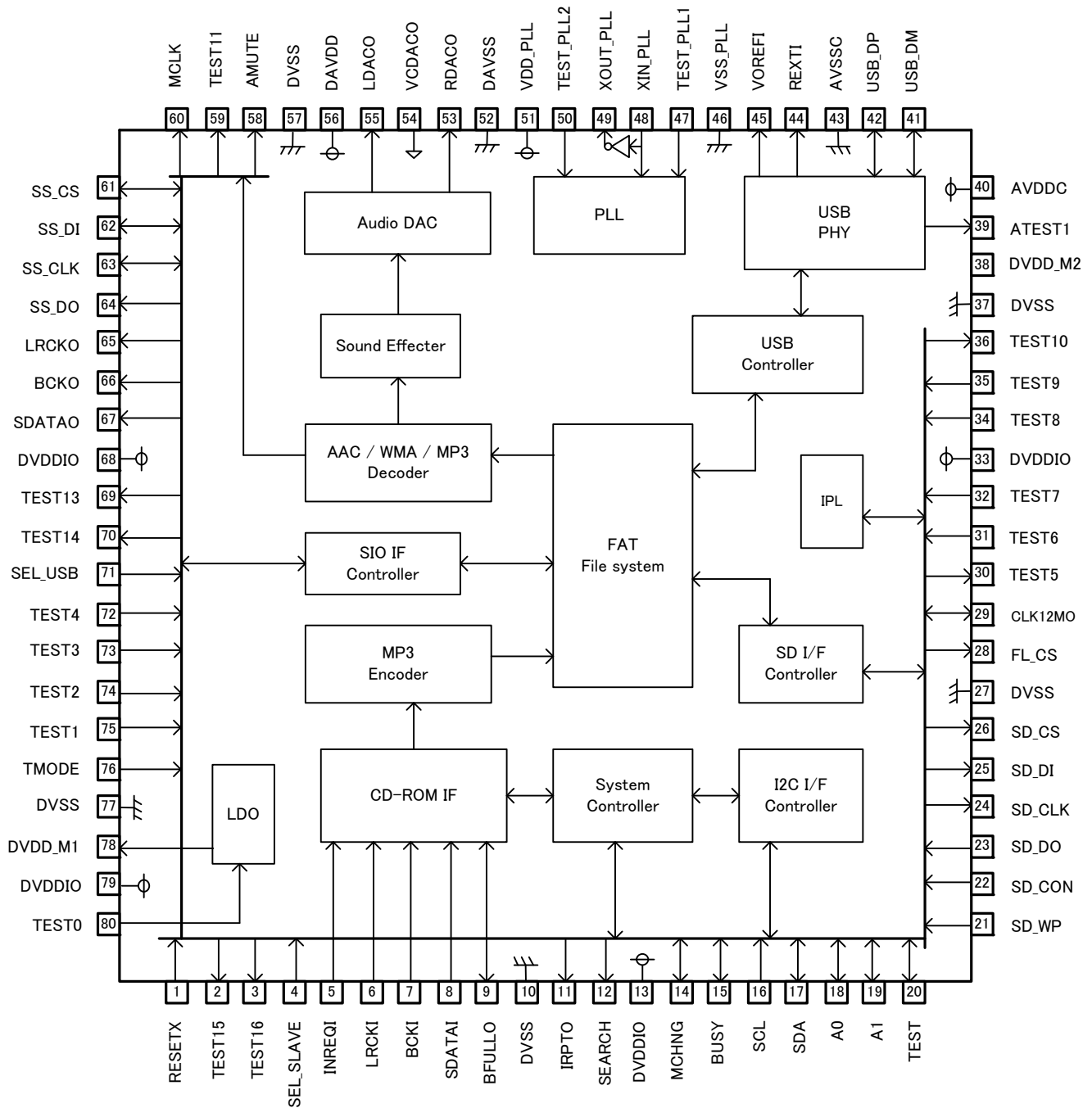
*6 24-26, 28, 29 pin

*7 49 pin

*8 41, 42 pin

*9 53, 55 pin

2. Block diagram



Block diagram

3. Description of Terminals

| No | Pin Name | IO Cir | IO | PU | Function |
|----|-----------|--------|-----|----|---|
| 1 | RESETX | A | I | PU | 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 |
| 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 |
| 10 | DVSS | - | - | - | GND terminal |
| 11 | IRPTO | B | O | - | Connection interrupt output terminal |
| 12 | SEARCH | B | O | - | Search flag output terminal |
| 13 | DVDDIO | - | - | - | IO power (VDD1) terminal |
| 14 | MCHNG | B | O | - | File play end flag output terminal |
| 15 | BUSY | B | O | - | Command analysis BUSY output terminal |
| 16 | SCL | I | I | *2 | I ² C slave clock input terminal |
| 17 | SDA | I | I/O | *2 | I ² C slave data I/O terminal |
| 18 | A0 | B | I | - | I ² C slave address setting terminal |
| 19 | A1 | B | I | - | I ² C slave address setting terminal |
| 20 | SEL_I2C | B | I | - | Test mode terminal. Pull it up at VDD1 power. |
| 21 | SD_WP | B | I | PU | SD card I/F WP detection terminal |
| 22 | SD_CON | B | I | PU | 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 |

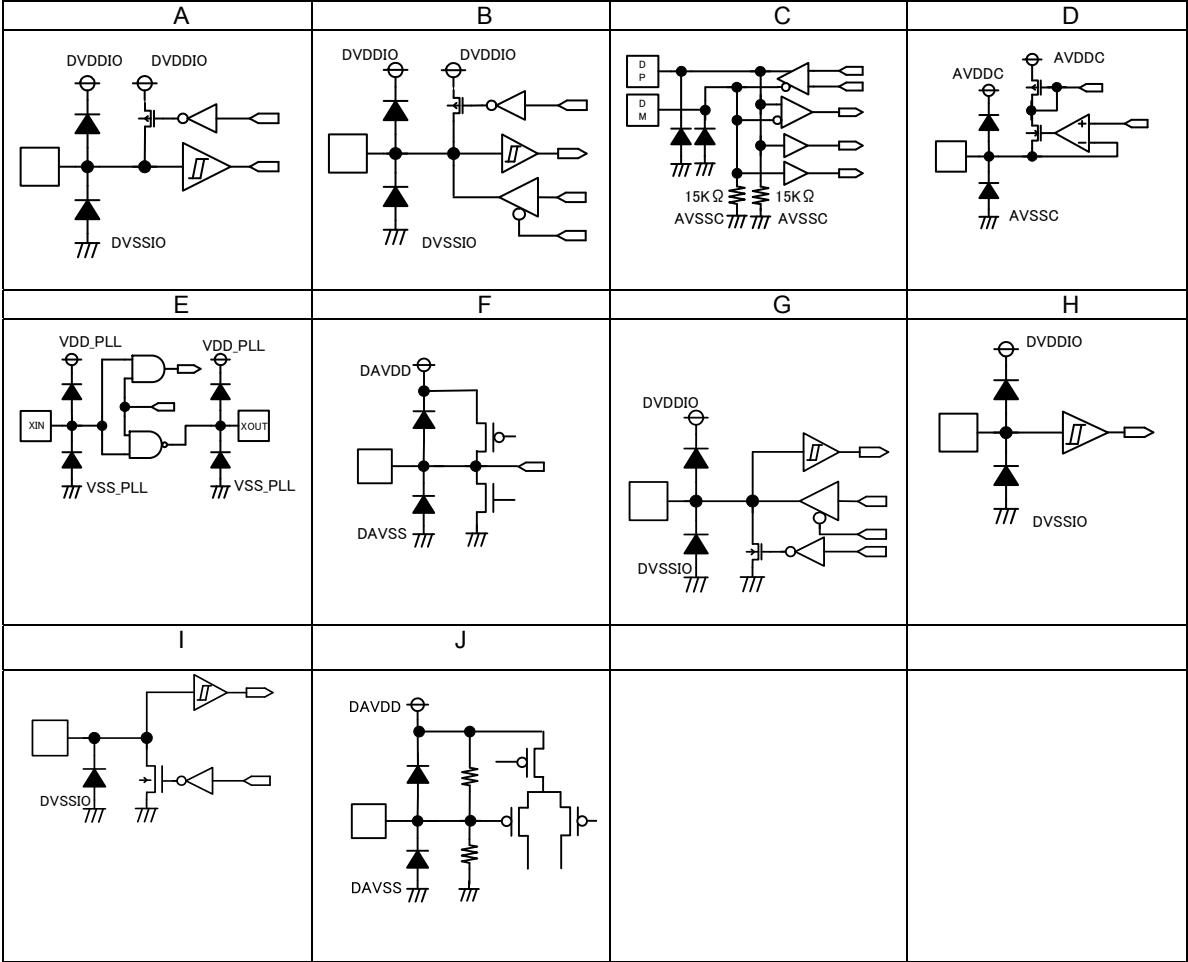
| | | | | | |
|----|-----------|---|-----|------|---|
| 41 | USB_DM | C | I/O | - | USB D-I/O terminal |
| 42 | USB_DP | C | I/O | - | USB D+ I/O terminal |
| 43 | AVSSC | - | - | - | USB GND terminal |
| 44 | REXTI | D | O | - | USB reference voltage output terminal Connect to AVSSC terminal using USB bias resistor (12kΩ). Please arrange the resistance of 12kΩ near PIN. The wiring for the PIN side must not intersect with other signal lines. |
| 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. |
| 49 | XOUT_PLL | E | O | - | X'tal (16.9344MHz) connection output terminal. |
| 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 | 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. Terminal equivalent circuit diagram



I/O terminal equivalent circuit diagram

5. I/O Signal Specifications

5.1 Clock and Reset

Clock

| Clock name | I/O | Function | Remarks |
|------------|-----|--|---------|
| 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 5.1.)

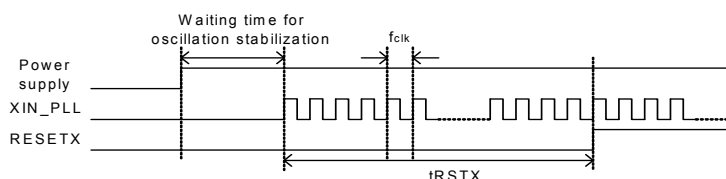


Figure 5.1 Reset Timing

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

5.2 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 supports external HUB.

5.3 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 supports 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.

5.3.1 Timing

Load=20pF, 10kΩ

| Parameter | Symbol | Min | Typ | Max | unit |
|--------------------------|--------|-----------|------|----------|------|
| 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*VDD | | | V |
| Output Low Voltage | Vol | | | 0.25*VDD | V |

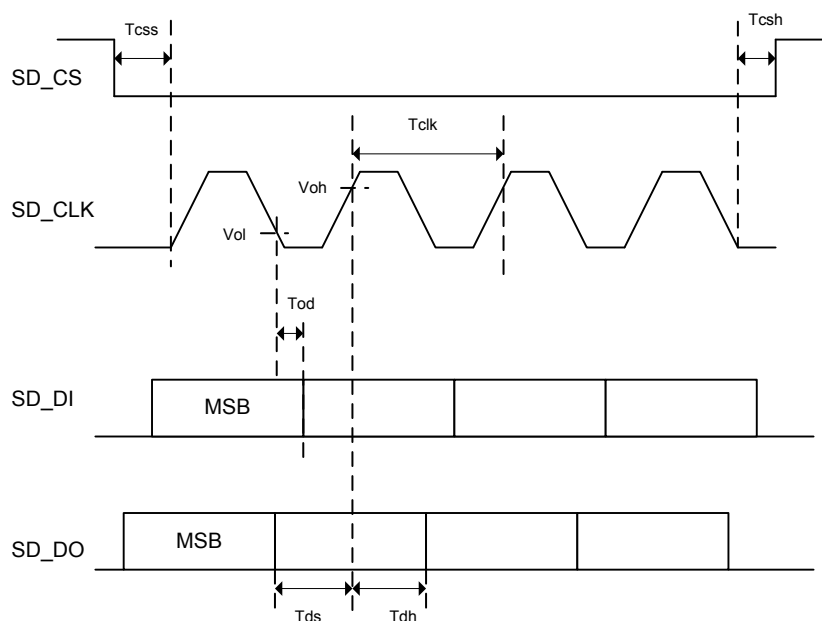


Figure 5.3 SPI I/F Timing

5.4 Audio line output

Audio line output

| Signal name | I/O | Function | Remarks |
|-------------|-----|-----------------------|---------|
| 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 48kHz and 32kHz is converted into 44.1kHz and output.

Figure 7. shows the relationship between audio outputs and volume steps.

The initial value is -24.1dB at power ON.

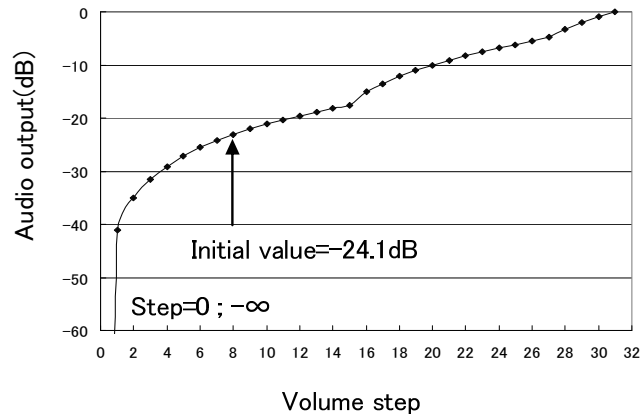


Figure 5.4 Volume Step Function

5.5 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 5.5 shows the operation waveforms.

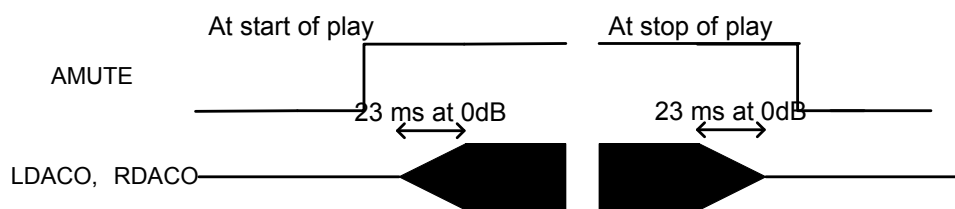


Figure 5.5 Waveform at Audio Mute

5.6 Digital Audio output

Three-line serial Digital audio interface

| Signal name | I/O | Function | Remarks |
|-------------|-----|------------------------------|---------|
| LRCK | O | LR clock output (fs=44.1kHz) | - |
| BCK | O | Bit clock output | - |
| DATA | 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 48kHz and 32kHz is converted into 44.1kHz and output.

5.6.1 Output Format

Figures 5.6.1, 5.6.2, 5.6.3, 5.6.4, 5.6.5 and 5.6.6 show the output formats.

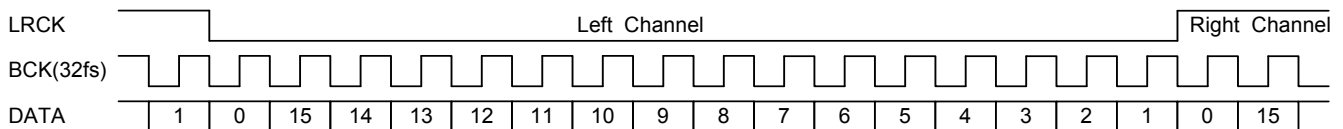
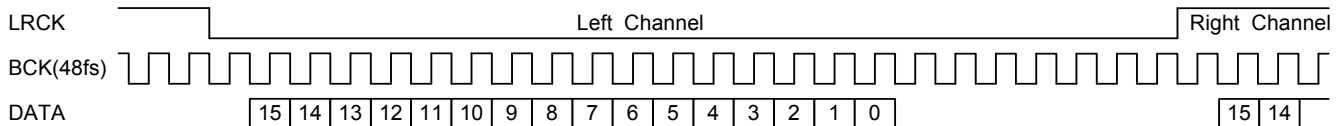
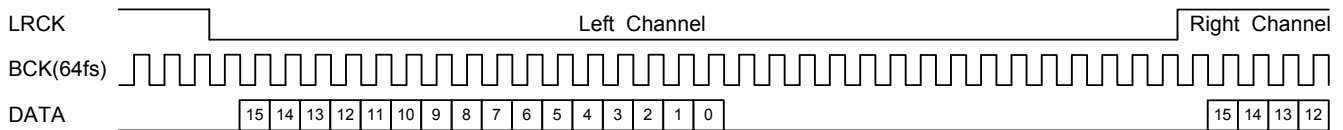
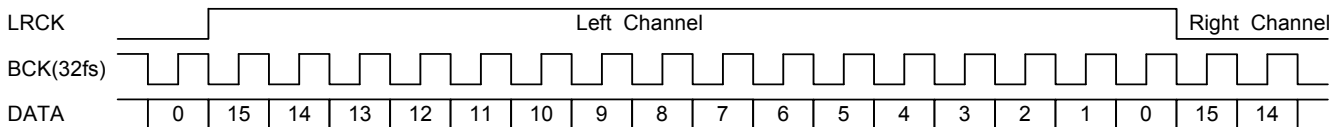
Figure 5.6.1 I²S Output Timing (32fs)Figure 5.6.2 I²S Output Timing (48fs)Figure 5.6.3 I²S Output Timing (64fs)

Figure 5.6.4 EIAJ Output Timing (32fs)

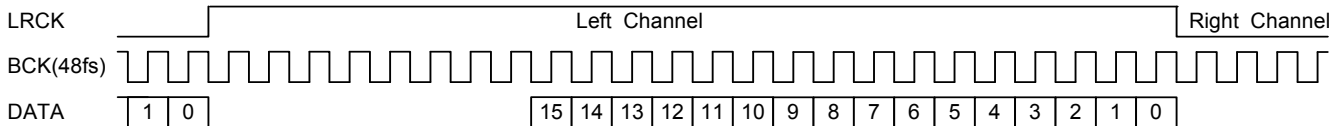


Figure 5.6.5 EIAJ Output Timing (48fs)

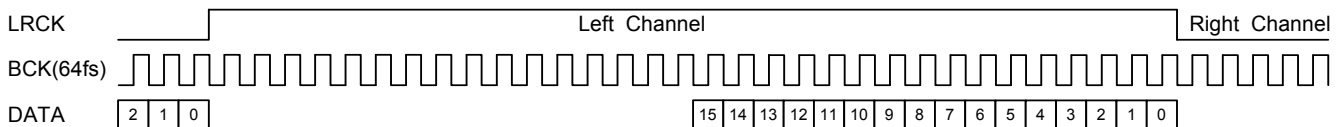


Figure 5.6.6 EIAJ Output Timing (64fs)

5.6.2 Timing

Load=20pF, 48fs

| Parameter | Symbol | Min | Typ | Max | unit |
|----------------------|--------|----------|-------|-----|------|
| BCK Clock Frequency | Tbck | 452 | 472.4 | 492 | ns |
| BCK Low time | Tbck1 | - | 236 | 256 | ns |
| BCK High time | Tbck2 | - | 236 | 256 | ns |
| LRCK Clock Frequency | Tlrck | - | 44.1 | - | MHz |
| LRCK Output delay | Tlrck1 | -20 | 0 | 20 | ns |
| DATA Output delay | Tdh | -20 | 0 | 20 | ns |
| Output High Voltage | Voh | VDD1-0.4 | | | V |
| Output Low Voltage | Vol | | | 0.4 | V |

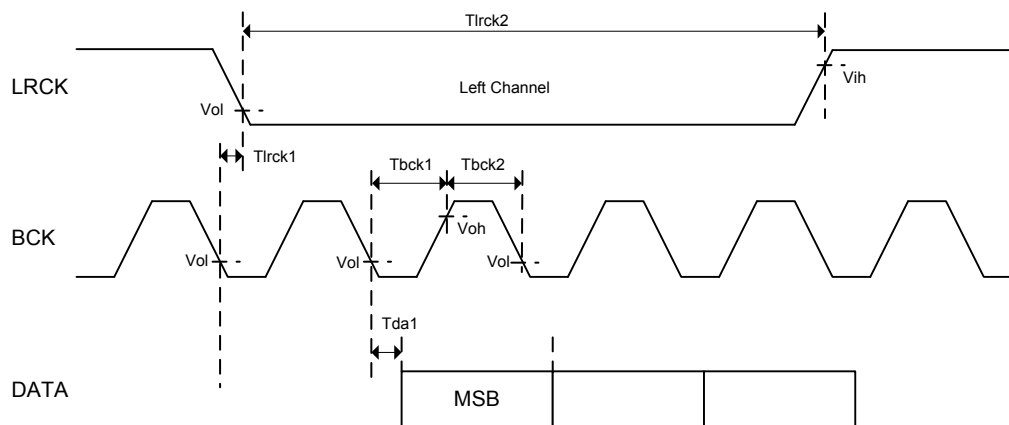


Figure 5.6.7 Output Timing

5.7 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 48kHz and 32kHz is converted into 44.1kHz and output.

5.7.1 Format,

Figure 5.7 shows the SPDIF signal output format.

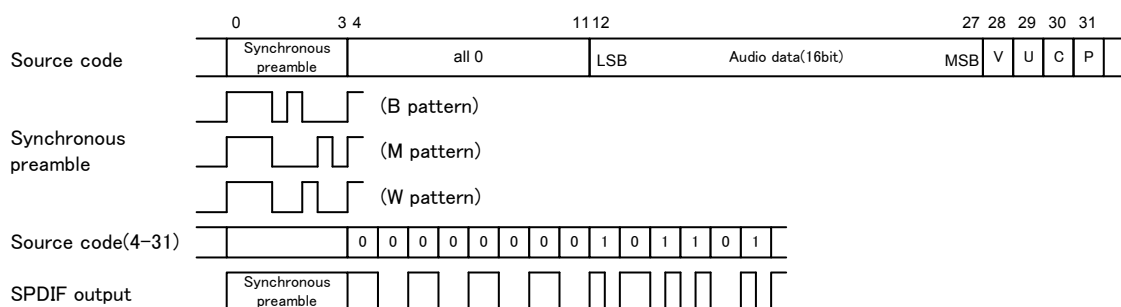


Figure 5.7 SPDIF Output Format

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(44.1kHz).

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 Tables 5.7.1 and 5.7.2. V bit is fixed to L. U bit uses 98 frames (≈ 13.3 ms) for one cycle.

Table 5.7.1 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 5.7.2 C Bit Format

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

Table 5.7.3 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.

5.7.2 Timing

Load=20pF,

| Parameter | Symbol | Min | Typ | Max | unit |
|-----------------------|--------|----------|-------|-----|------|
| SPDIF Clock Frequency | Tck | - | 2.822 | - | MHz |
| SPDIF Clock High time | Tck1 | 150 | 177 | - | ns |
| SPDIF Clock Low time | Tck2 | 150 | 177 | - | |
| Output High Voltage | Voh | VDD1-0.4 | - | - | V |
| Output Low Voltage | Vol | - | - | 0.4 | V |

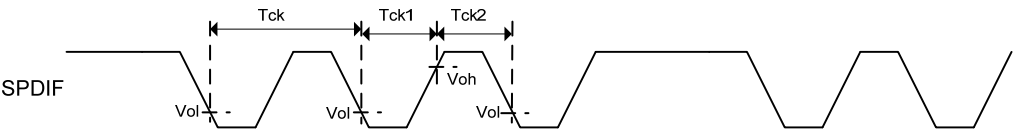


Figure 5.7.2 SPDIF Output Timing

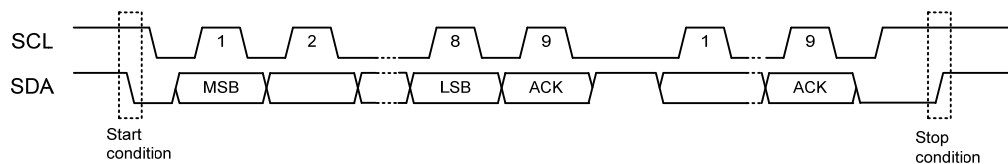
5.8 I²C command interfaceSlave I²C serial interface

| Signal name | I/O | Function | Remarks |
|-------------|-----|--|--|
| SCL | I | I ² C interface clock input | External pull-up resistor is required. |
| SDA | I/O | I ² C 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.

5.8.1 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 5.8.1 shows Start condition, Stop condition of I²C.

Figure 5.8.1 I²C Start and Stop Conditions

5.8.2 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 5.8.2. Figure 5.8.2 shows the slave address transfer format.

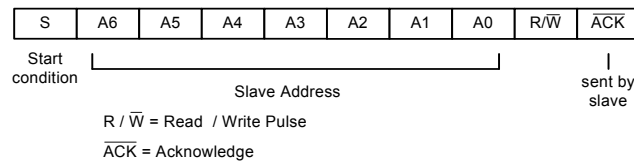


Figure 5.8.2 Slave Address Transfer Format

Table 5.8.2 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 |

5.8.3 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 5.7.3. For details on each command, see Chapter 7.

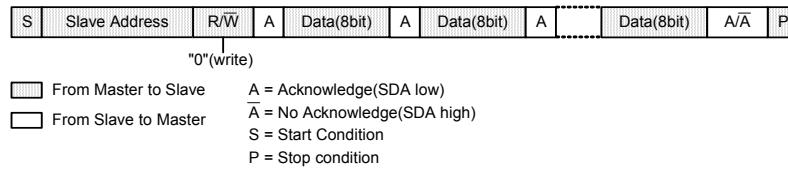


Figure 5.8.3 Command Send Protocol

5.8.4 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 shown in Figure 5.8.4.1. First, transfer the status read command (step1). Then, input SCL clock of required bytes in step2 to read the status.

If the device status is BUSY when receiving the device status or the data within the memory, the I²C bus may be occupied by the device in BUSY. This LSI transfers the data to the master to avoid such occupation of the bus. However, as the BUSY status still exists internally, the proper data may not be transferred in BUSY. To cope with this situation, the first byte of the transfer data (step2) is used to judge whether the transferred data is valid or invalid. After addressing from the master to the slave, if the 0 bit of the first byte of the transfer data immediately after requiring the data transfer is 0, the data transferred from the slave is valid. If the 0 bit of the first byte is 1, it shows the BUSY status. Thus, judge all the transferred data to be invalid. If this happens, retry Step1 to send commands to read the status.

The first byte of the transferred data (step2) can be readable as the BUSY byte even without sending the status read command (step1). In addition, internal statuses other than BUSY shown in Table 5.8.4 can be read.

Figure 5.8.4.2 shows the relationship between the transferred data and BUSY.

* For details on BUSY, see 5.9.

Table 5.8.4 BUSY Byte Structure

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

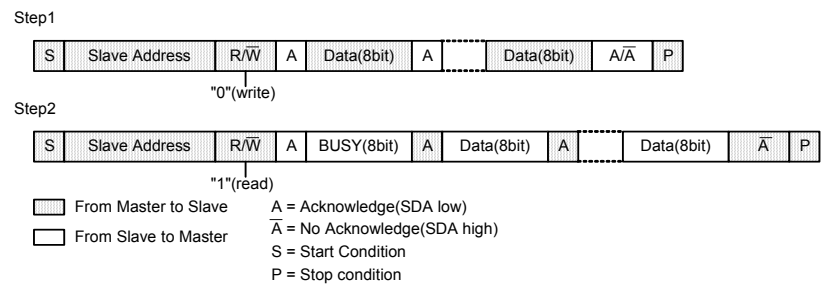


Figure 5.8.4.1 Status Reception Protocol

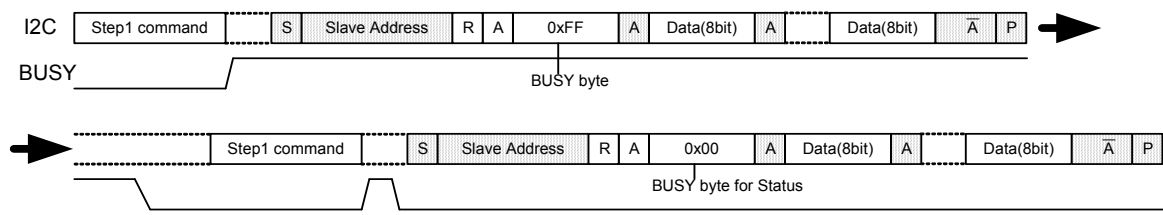


Figure 5.8.4.2 Relationship between Transferred Data and BUSY

5.8.5 I²C Bus line timing

SDA and SCL bus-line characteristic (Unless specified, Ta=25°C, Vcc=3.3V)

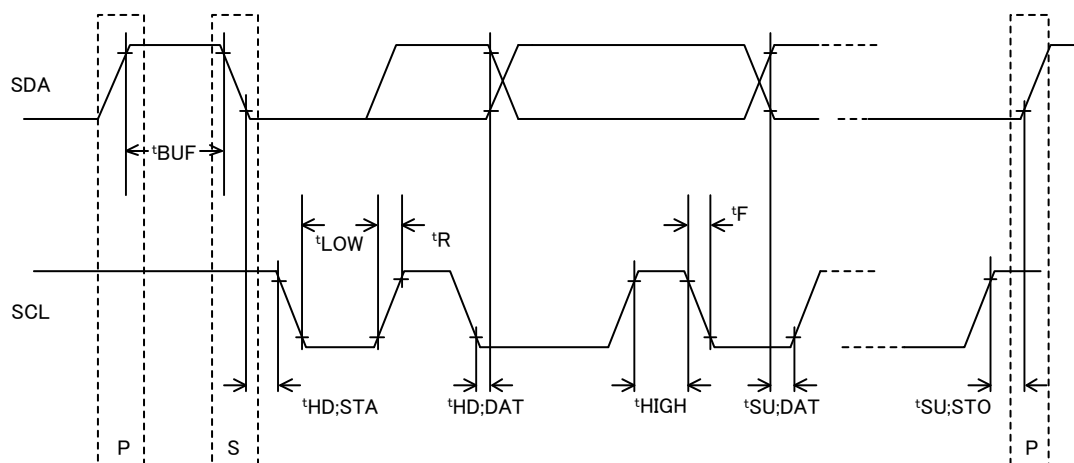
| Parameter | | Code | Min. | Max. | Unit |
|-----------|--|---------------------|-----------|---------|------|
| 1 | SDA, SCL H input voltage | V _{IH} | VDD*0.7 | VDD | V |
| 2 | SDA, SCL L input voltage | V _{IL} | DVSS | VDD*0.3 | V |
| 3 | SDA H output voltage | V _{OH} | VDD-0.4 | VDD | V |
| 4 | SDA L output voltage | V _{OL} | 0 | 0.4 | V |
| 5 | SCL clock frequency | f _{SCL} | 0 | 400 | kHz |
| 6 | Bus-free-time between "Stop" condition and "Start" condition | t _{BUF} | 1.3 | — | us |
| 7 | Hold time for "Start" condition After this, the first clock pulse is generated. | t _{HD;STA} | 0.6 | — | us |
| 8 | LOW status hold-time of SCL clock | t _{LOW} | 1.3 | — | us |
| 9 | HIGH status hold-time of SCL clock | t _{HIGH} | 0.6 | — | us |
| 10 | Data-hold-time | t _{HD;DAT} | 0* | — | us |
| 11 | Date-setup-time | t _{SU;DAT} | 100 | — | ns |
| 12 | Rising time of SDA and SCL signal | t _R | 20+0.1*Cb | 300 | ns |
| 13 | Fall time of SDA and SCL signal | t _F | 20+0.1*Cb | 300 | ns |
| 14 | Setup time of "Stop" condition | t _{SU;STO} | 0.6 | — | us |
| 15 | Capacitive load of each bus-line | C _b | — | 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.



5.9 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 with the microcomputer and use it.

5.10 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 with the microcomputer and use it.

5.11 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 with the microcomputer and use it.

5.12 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.

Please connect with the microcomputer and use it.

5.13 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.

4X max input speed supports. However, since encoding speed is 2X max, more than in 2X input speed, handling of a buffer FULL output generates it.

(Buffer FULL outputs depend also on a write-in speed for every memory.)

Builds in the CD-ROM decoder function.

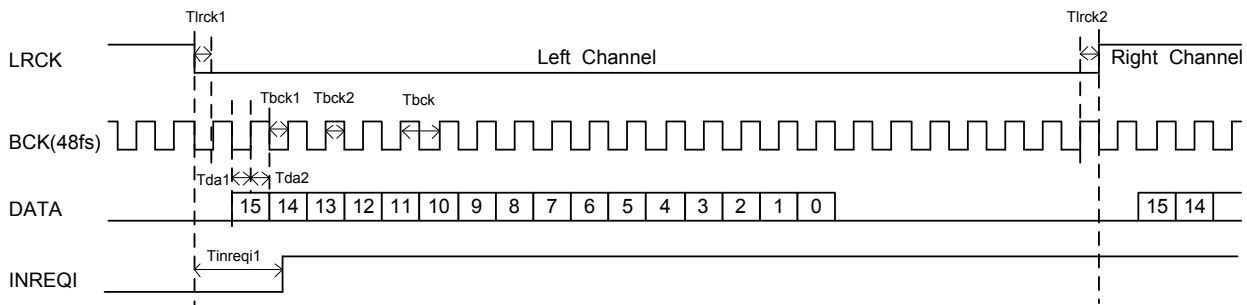
5.13.1 Input format

You can select the input format from the EIAJ format and I²S 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.

Perform the required settings using commands before inputting data.



Figure

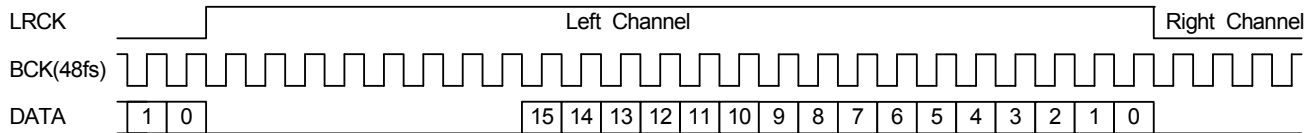
5.13.1.1 I²S Input format (48fs)

Figure 5.13.1.2 EIAJ Input format (48fs)

5.13.2 Timing

Load=20pF

| Parameter | Symbol | Min | Typ | Max | unit |
|--------------------|----------|----------|--------|----------|------|
| 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 |

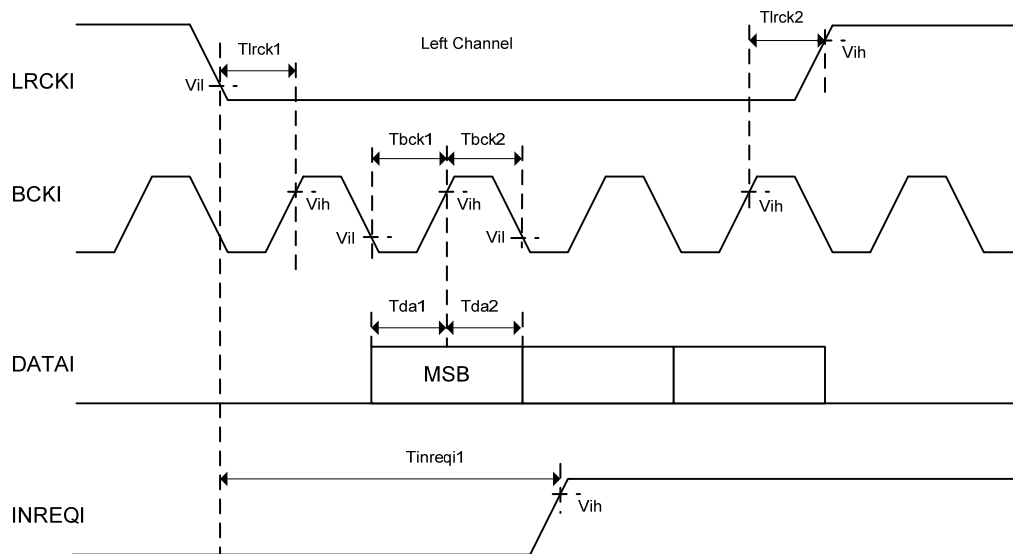


Figure 5.13.2 CD I/F Timing

5.13.2 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.

5.13.3 BFULLO

BFULLO outputs H when the internal buffer becomes FULL because the data input speed is too fast to manage the internal encoding.

When BFULLO=H, writing in the memory is not done until becoming INREQI=L.

When BFULLO=H, the microcomputer obtains the current play position of the CD and set to INREQI=L. After finding BFULLO=L, reduce the CD rotation speed and then perform comparison connection or retry encoding starting from the top of the tune.

When INREQI=H and BFULLO=L, the IC fetches the input data to the internal buffer.

5.14 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).

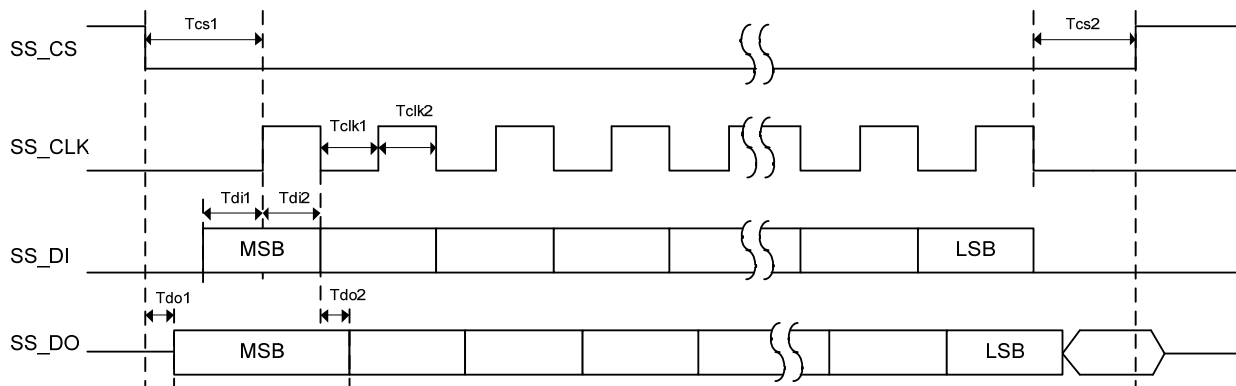
You can select the data width from 8, 16 and 32 bit.

An input clock is 2MHz at the maximum.

The interface is available to read and write the specific file data from/to the memory.

5.14.1 Format

It supports the SPI format (MODE0,1,2 and 3).

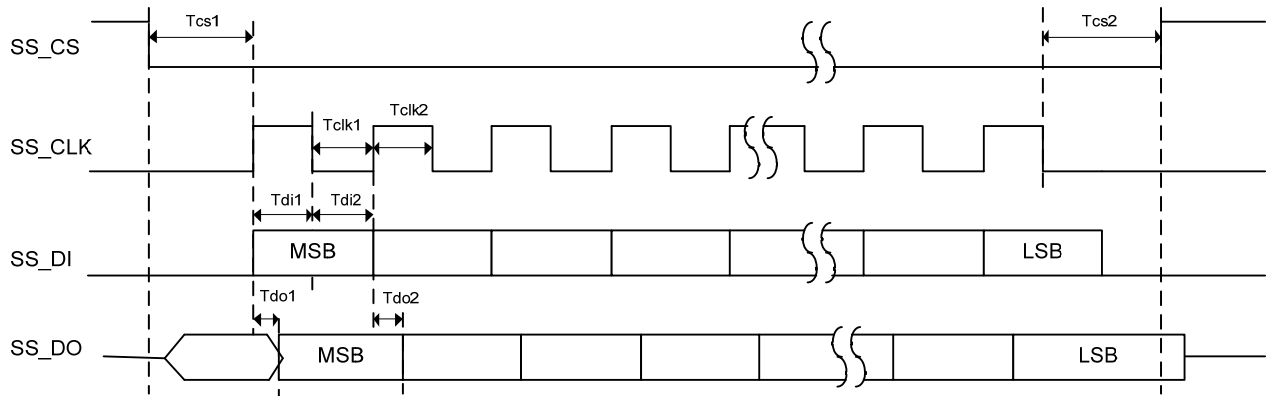


8 or 16 or 32bit – SPI MODE0 Serial Format (SCPH=0)

SS_CLK rise edge; data capture , fall edge; data shift

SPI MODE2 is opposite in the clock polarity in SPI MODE0.

Figure 5.14.1.1 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 5.14.1.2 SPI MODE1 Serial Timing

5.14.2 Timing

SPI I/F Load=20pF

| Parameter | Symbol | Min | Typ | Max | unit |
|------------------------|--------|----------|-----|----------|------|
| SS_CLK Low time | Tclk1 | 250 | - | - | ns |
| SS_CLK High time | Tclk2 | 250 | - | - | ns |
| pulse width controlled | - | - | - | 100 | |
| SS_CS Setup time | Tcs1 | 500 | - | - | ns |
| SS_CS Hold time | Tcs2 | 250 | - | - | ns |
| SS_CS High time | Tcsh | 0 | - | - | |
| 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 | - | |
| Input High Voltage | Vih | VDD1*0.7 | - | - | V |
| Input Low Voltage | Vil | - | - | VDD1*0.3 | V |

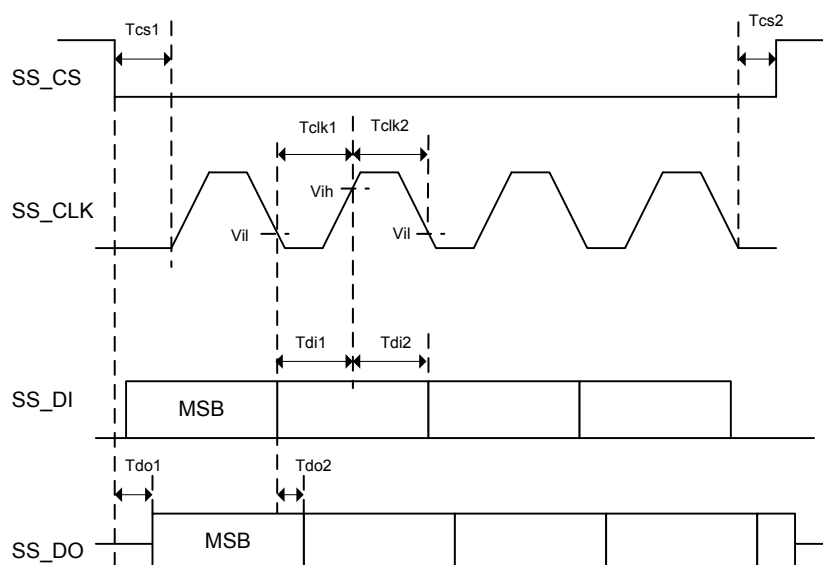


Figure 5.14.2 SPI Timing

5.23 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.

6. Functions and Operations

6.1 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

| 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 play 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. |
| 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 upload 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. |

6.2 File search

6.2.1 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 follows the specification of FAT.

Table 6.2.1 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.

6.2.2 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

- [1] SET_MP3: For details, see SET_MP3 command.
- [2] Attribute: Files with hidden attributes are also playable. Files with system attributes cannot be played.
- [3] File name: The file name, including its size, does not depend on playability.
- [4] 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.

6.2.3 File playing sequence

The file playing sequence depends on the following rules when sort function valid. See Figure 6.2.3.

- [1] Files of 1 to 100, in the order written to FAT (FAT order) in each folder, are sorted in the order of UNICODE (see 6.2.4). 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.

6.2.4 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 treat these 2 bytes as one character.

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

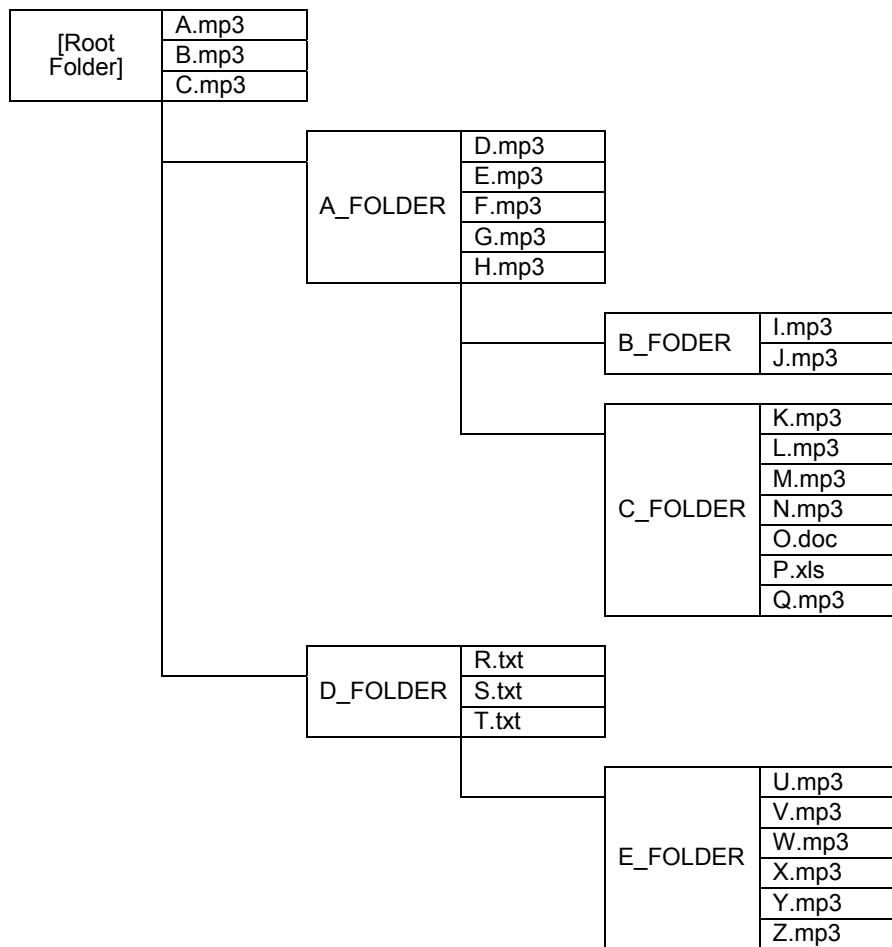


Figure 6.2.3 Example of Folder/File Structure within the Memory Device

Table 6.2.3 File Play Sequence for Folder/File Structure in Figure 6.2.3

| 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 | |

6.2.5 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.

6.2.6 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.

6.3 Playing files

6.3.1 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 44.1kHz, the sample after the decode is converted into 44.1kHz with sample rate converter (SRC) of building into and output.

6.3.2 Playable file formats

6.3.2.1 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).

6.3.2.2 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.

6.3.2.3 AAC file format

This format supports MPEG4 AAC-LC.

It conforms to iTunes and 3GPP TS 26.244.

It supports file types of m4a, mp42 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.

6.3.2.4 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.

If you try to play a file created in any format other than above, the LSI immediately terminates decoding it.

6.3.3 Playing files having damaged data

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.

6.3.4 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:** After playing all the tunes within the memory in process, starts playing them from the beginning of the memory.
- [2] **REPEAT_FOL:** Repeats playing tunes within the folder in process.
- [3] **REPEAT_TUN:** Repeats playing the tune in process.
- [4] **RANDOM_ALL:** Plays the range of ± 128 files from the current tune being played at random within the memory.
- [5] **RANDOM_FOL:** Plays the range of ± 128 files from the current tune being played at random within the folder in process.

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.

| | REPEAT_ALL | REPEAT_FOL | REPEAT_TUN | RANDOM_ALL | RANDOM_FOL |
|---------------|------------|------------|------------|------------|------------|
| PLAY_NEXT | ○ | ○ | ○ | ○ | ○ |
| PLAY_ALL_STOP | ○ | × | × | × | × |
| PLAY_FOL_STOP | ○ | ○ | × | × | × |
| PLAY_TUN_STOP | ○ | ○ | ○ | ○ | ○ |

6.3.5 Resume playing function

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

Table 6.4.5.1 Resume information register structure

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

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.

6.3.6 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 6.3.6.1 to 6.3.6.6 show frequency characteristics of each filter.

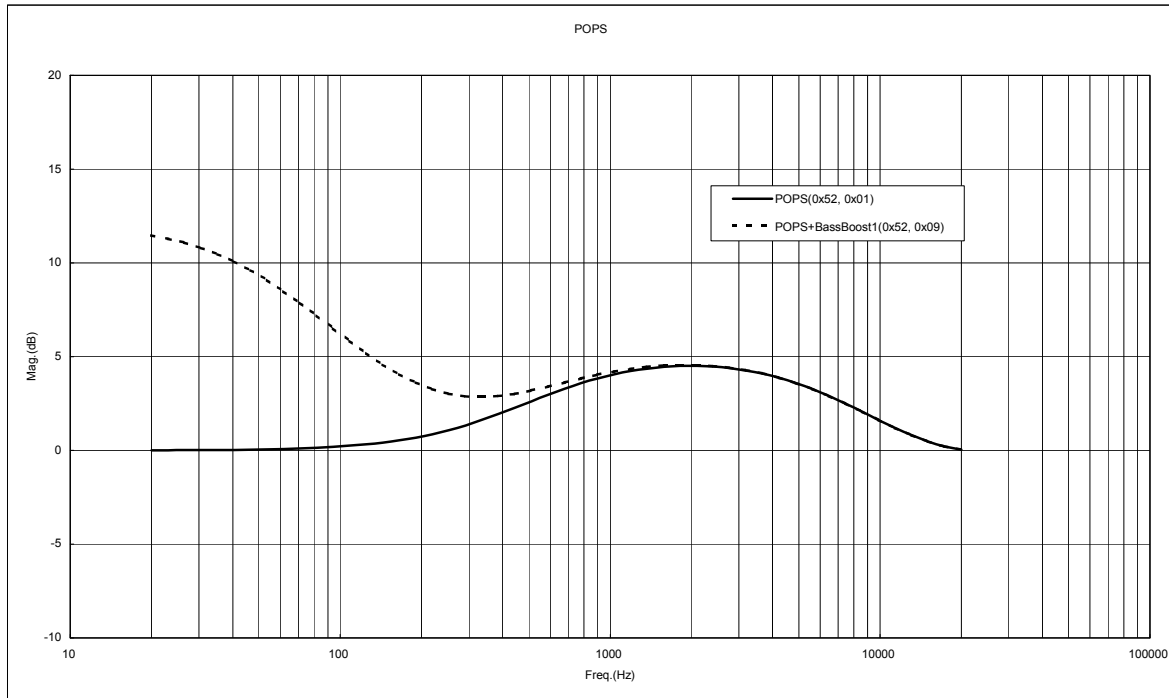


Figure 6.3.6.1 POPS Frequency Characteristics

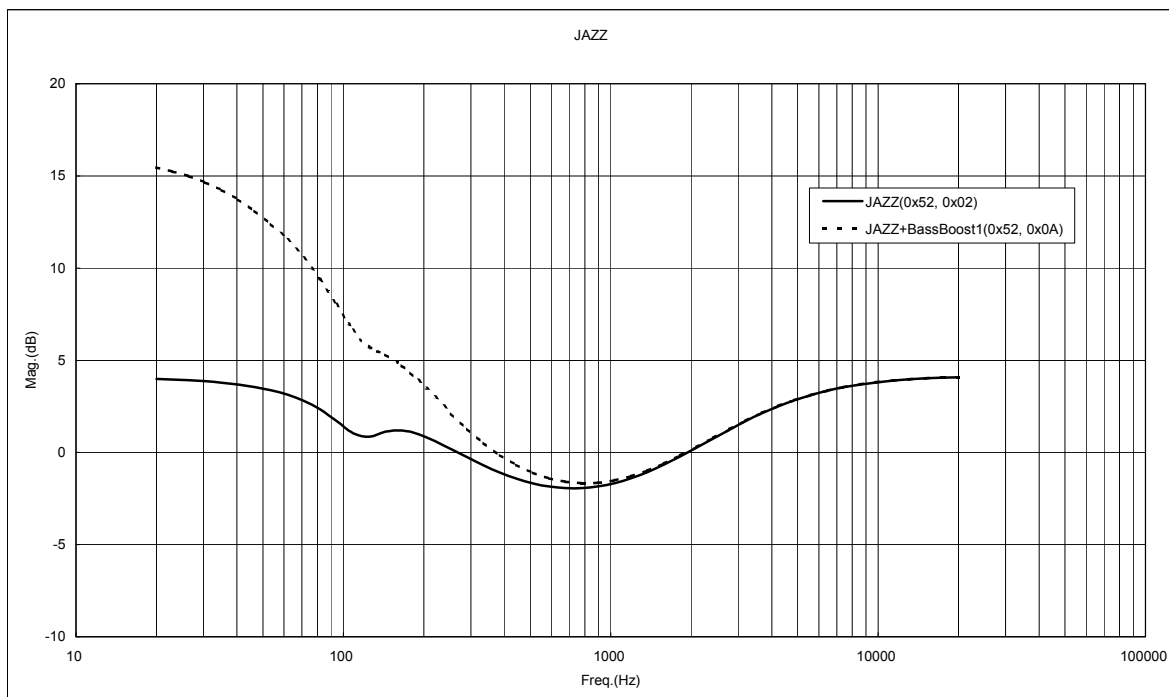


Figure 6.3.6.2 JAZZ Frequency Characteristics

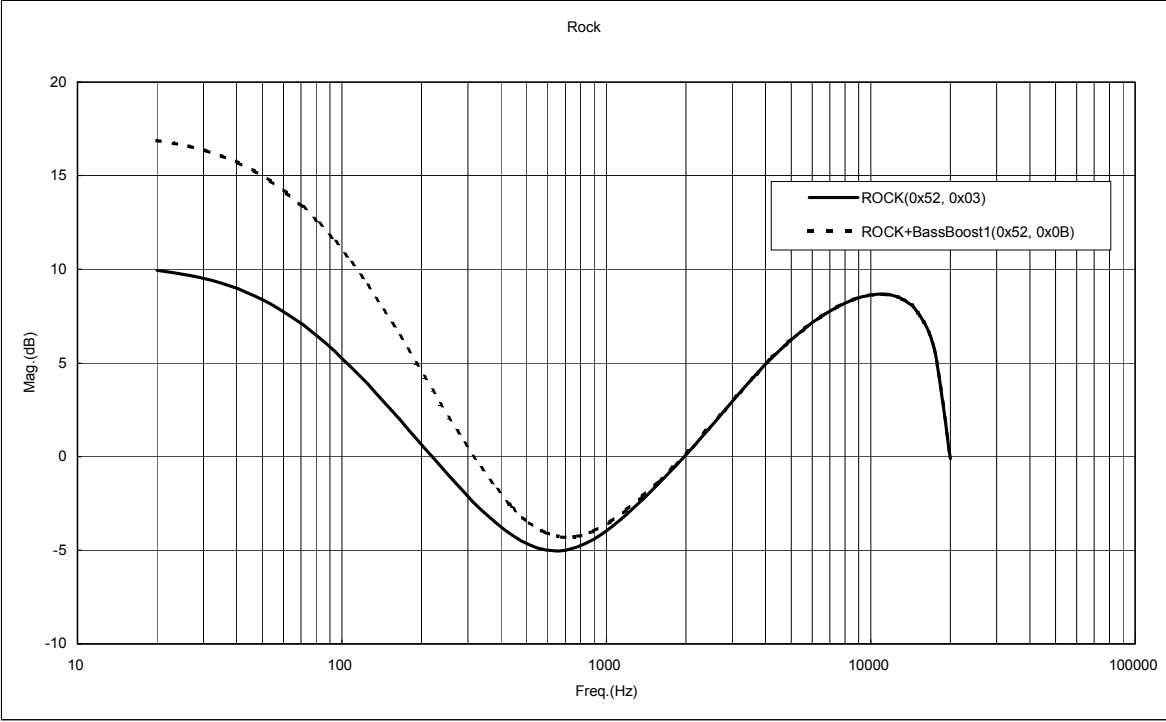


Figure 6.3.6.3 ROCK Frequency Characteristics

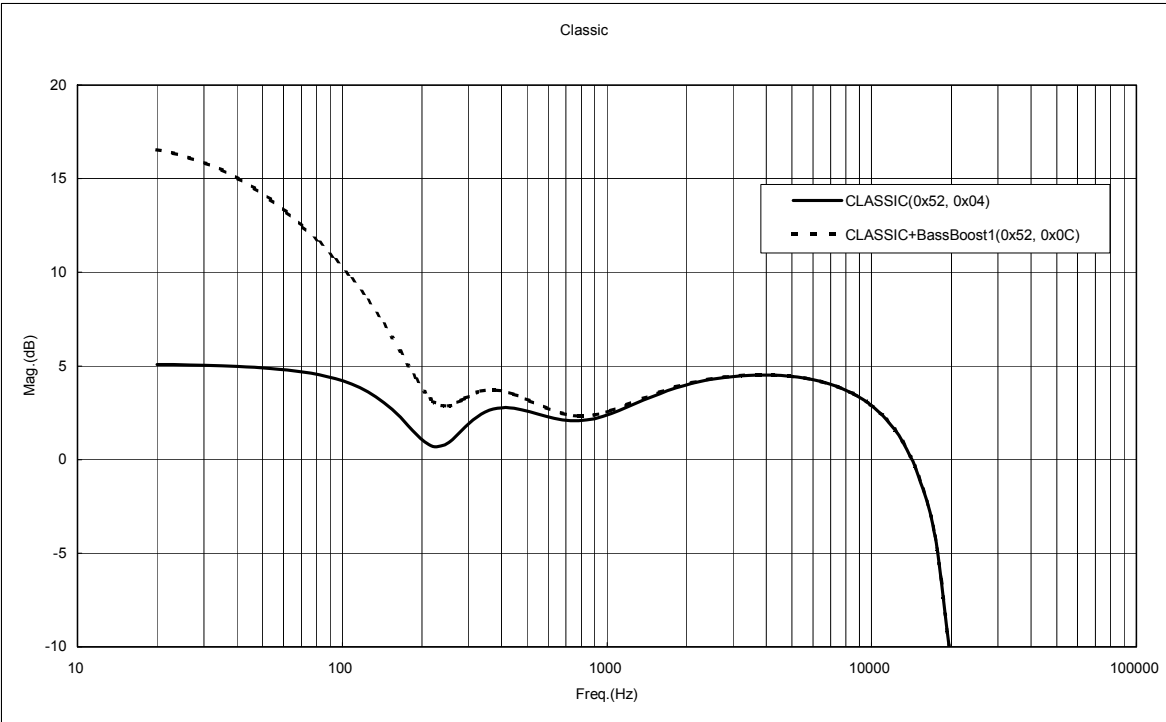


Figure 6.3.6.4 CLASSIC Frequency Characteristics

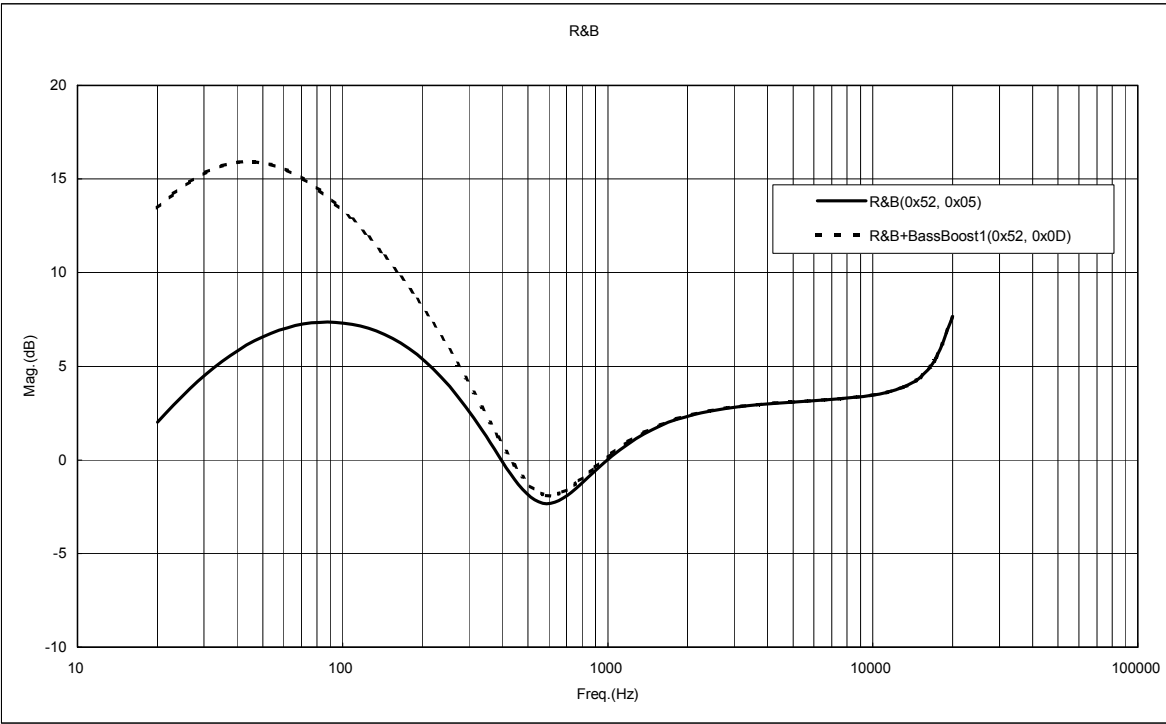


Figure 6.3.6.5 R&B

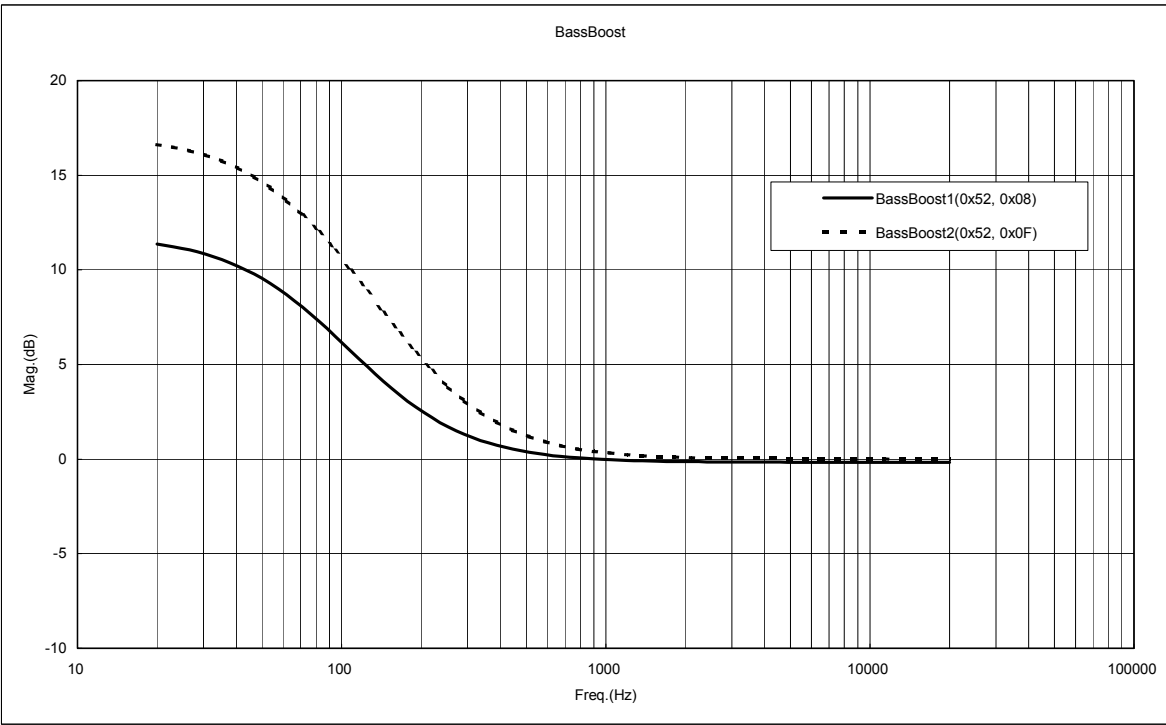


Figure 6.3.6.6 Bass Boost

6.3.7 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 6.3.7.1.

Table 6.3.7.1 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 6. 3.7.2 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 6. 3.7.3 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) |

6.4 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.

File Browsing within the memory will be enabled by: operating the cursor position which can be controlled separately from the position of the tune being played and analyzing the folder to read the information on folders.

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

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

Playing file number in the memory status

The file information status register structure which can be read by the file browsing function in a memory is shown in Table 6.4.1.

Table 6.4.1 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 are 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 become 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 are 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 plaining, music skipping may occur by the memory with a slow access speed.

6.5 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 SHIFT-JIS.

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, an one music repeat, and random in a memory setting up a repeat setup by the SET_REPRAND command.

6.6 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.

Specification of a file name is specified by the full path (less than 256 bytes) including a file name and an extension.

A full path including a file name and an extension supports to 16 classes within 256 bytes.

A full path is acquirable with browsing operation.

Deletion of a file is possible at the time of browsing operation.

6.7 CD data ripping

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.

Specify the file name using the full path (within 256 bytes) including the file name and extension. The file full path including the file name and extension should be within 256 bytes and available with 16 layers at maximum.

The LSI can also write TAG data of TITLE, ARTIST, ALBUM, and GENRE of up to 64 bytes each to the encoded file. Set the file name, folder name and TAG data before issuing the command to start encode.

6.7.1 Input supporting formats

16-bit EIAJ format or 16-bit I²S format

Sample rate: 32 kHz, 44.1 kHz, 48 kHz

Bit clock: 32 fs, 48 fs, 64 fs LRCK

LRCK input speed: MAX=4 X speed

However, since encoding speed is 2X max, more than in input speed 2X, handling is needed to a buffer FULL output. The LRCK input speed of the state where an internal buffer is not set to FULL(BULLO=H) is a correspondence schedule to MAX=2X speed. (when encoding of MP3 128kbps and use SONY USB Memory; Pocket Bit series) However, writing speed differs by memory.

Therefore, 2X speed support can't guarantee support of operation to all memory.

6.7.2 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

6.7.3 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.

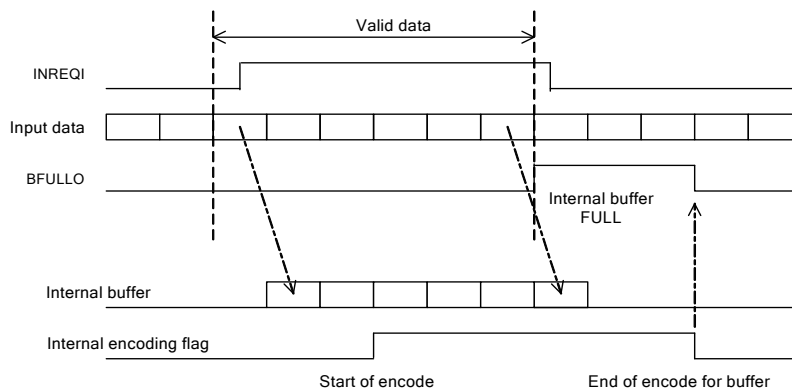
[1] The command to enable the encode function turns ON.

[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.



6.7.4 Data comparison connection function

Using this function, the LSI can hold the last three samples of data written to the internal buffer as valid data, compares them to those entered after the comparison connection operation starts, includes the samples to the internal buffer if they match the compared ones, and then restarts encoding. Besides comparison connection, this function also allows the LSI to connect the data directly by controlling INREQI input and restart encoding.

Immediately after BFULLO becomes H, let the microcomputer set INREQI input terminal to L and read the CD play time and then stop CD. After BFULLO terminal becomes L, select the comparison connection function or retry from the beginning to restart playing the CD.

The situation that BFULLO becomes H is generated because the CD play speed is too fast for the internal encoding operation. To avoid this, slow down the CD play speed.

To stop encoding once when an error occurs on the CD, immediately let the microcomputer read the CD play time and set INREQI input terminal to L.

6.8 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.

The result of file system analysis holds the maximum about 350 entry (folders+ files) grade to an internal buffer, when a file name or a folder name consists of 48 bytes as a standard. When 32 bytes or less are constituted, an analysis result holds the maximum about 450 entry grade to an internal buffer. An analysis result is outputted to status.

The entry which was not able to be held to the buffer domain for analysis cannot be played after file system analysis.

Moreover, since analysis is performed from the class of a higher rank, when the buffer domain for analysis is set to FULL before the analysis of a playable file by the reasons of a higher rank class having many folders, it may be unable to play depending on the structure in CD-ROM. The number of entries which can be held to the buffer for analysis changes depending on the contents of composition of each CD-ROM.

The input data buffer of about 100 kB is built in. (A file system analysis result is also included.)

CD-ROM ECC and the EDC function are supported.

Refer to the CD data ripping for CD input data format and input terminal specification.

6.8.1 Support File System

CD-ROM Mode1, Mode2 form1, and Mode2 form2 are supported.

The file system supports ISO9660 level 1 and 2. Remo 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.

6.8.2 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.

When a SEEK request occurs, a microcomputer should perform playing from at least 1 sector before from requested LBN.

If a request sector is inputted, it will be automatic, connection operation will be performed and subsequent data will be processed.

6.8.3 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 6.8.3.1 CD file 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 : AAC 0x04 : WAV 0x05 : Play list file 0x06-0x0E : 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 6.8.3.2 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 6.8.3.3 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. |

6.9 Interruption IRPTO Terminal to Microcomputer

An IRPTO terminal generates an interrupt request to a microcomputer.

Interruption becomes active by H.

The contents of interruption change with the states where it is operating mode. The contents are shown below.

Please detect a standup in the interruption port of a microcomputer.

| 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. |

6.10 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.

| 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 |

6.11 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.

| 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 CONFIGURATION |
| 0x4 | USB device which cannot be recognized |
| 0x5 | - |
| 0x6 | - |
| 0x7 | SD Card |
| 0x8-0xF | It means that there is HUB, when Bit7 is H. |

6.12 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.

| 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 recive |
| 0x03 | Configuration descriptor | 0x13 | Sector read status recive |
| 0x04 | End Point connect | 0x14 | Sector write command send |
| 0x05 | SET_Configuration | 0x15 | Sector write command recive |
| 0x06 | GET MAX LUN | 0x16 | Sector write status recive |
| 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.

| 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 filesystem analysis.

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

6.13 Watch Dog Timer

The LSI incorporates Watch Dog Timer, which monitors the system hang-up and resets whenever it occurs. After resetting hang-up, WDT (Watch Dog 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.

6.14 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 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 secs. This time changes with contents of the program writed in serial FLASH ROM.

The LSI supports a mode which enables to write the program data writen 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.

7 Command

7.1 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 7.1.1 shows the command specifications.

Table 7.1.2 shows enabled/disabled state of each command.

Table 7.1.1 Command Operations

| Command name | Comm and | Command | | | | Explanation of operation |
|-----------------|----------|---------|------|-----|------|--|
| | | 1st | 2nd | 3rd | 4th | |
| CONFIG | | | | | | |
| CHG_SYSTEM_MODE | 4 | 0x60 | 0x00 | N | 0x00 | <ul style="list-style-type: none">• Set up System Operation Mode.• Please choose 3rd byte N from the following. The other setup does not receive a command.<ul style="list-style-type: none">N= 0x00 ; CONFIG ModeN= 0x01 ; PLAYER ModeN= 0x02 ; FILE RW ModeN= 0x03 ; PLAY LIST ModeN= 0x04 ; CD-DA ModeN= 0x05 ; CD-ROM ModeN= 0x07 ; IPL WRITE Mode The initial setting is N= 0x00. |
| STOP | 2 | 0x60 | 0x01 | - | - | <ul style="list-style-type: none">• 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 | N | 0x00 | <ul style="list-style-type: none">• This command suspends the current analysis such as TAG analysis and folder analysis.• The LSI suspends analysis only and continues playing the file when receiving the ABORT command.• Select N at the 3rd byte from the following. Any other settings are considered to specify N=0x01. Specify the operation to be suspended at N.<ul style="list-style-type: none">N=0x00: Suspends TAG analysis before playing. The LSI continues playing the file.N=0x01: Suspends folder analysis. Since this sets the unanalyzed status after suspension, be sure to send the ANALYZE_ROOT command to redo analysis before obtaining the file contents. |

| | | | | | | |
|------------------|---|------|------|---|------|---|
| CHG_DEV | 2 | 0x60 | 0x03 | - | - | <ul style="list-style-type: none"> • 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 | - | - | <ul style="list-style-type: none"> • This command disables Watch dog Timer. • Initial setting is that Watch dog Timer function is effective. |
| SET_WDT | 2 | 0x60 | 0x05 | - | - | <ul style="list-style-type: none"> • This command writes "1" to STATUS_WDT_RFLG when it is executed. |
| SET_SORT | 4 | 0x60 | 0x06 | N | 0x00 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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. |

| | | | | | | |
|--------------|---|------|------|------|------|---|
| | | | | | | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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_IPL_UNIT | 4 | 0x60 | 0x0E | N | 0x00 | <ul style="list-style-type: none"> • Set up the unit which rewrites FLASH ROM when IPLWrite. • Select N at the 3rd byte from the following. Any setting other than N=0x00 is considered to specify N=0x01. N=0x00: Writes to FLASH by page. N=0x01: Writes to FLASH by byte. • Initial value is N= 0x00. It is page unit writing. |
| SET_UTPKT | 4 | 0x60 | 0x0F | N | 0x00 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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. • An initial value is N= 0x00. |
| SET_OUTLANG | 4 | 0x60 | 0x12 | 0x00 | N | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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_IDLE_TIME | 6 | 0x60 | 0x18 | 0x02 | 0x00 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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. |
| SET_THR2 | 12 | 0x6F | 0x00 | 0x00 | 0x00 | <ul style="list-style-type: none"> 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. |
| SET_THR3 | 12 | 0x6F | 0x00 | 0x00 | 0x00 | <ul style="list-style-type: none"> 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. |
| PLAY control | | | | | | |
| PLAY | 2 | 0x61 | 0x01 | - | - | <ul style="list-style-type: none"> 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. When receiving the PLAY command in the CONFIG mode, the LSI automatically goes to the PLAYER mode and plays the first tune in the sort order. |
| PAUSE | 2 | 0x61 | 0x02 | - | - | <ul style="list-style-type: none"> When receiving the PAUSE command during play, the LSI pauses playing of the file |
| HOME | 4 | 0x61 | 0x03 | N | 0x00 | <ul style="list-style-type: none"> When receiving the HOME command, the LSI searches files of the first tune within the memory. TAG analysis, if it is enabled, is performed. 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 | <ul style="list-style-type: none"> When receiving the PLAYMODE command, the LSI changes play mode in accordance with the setting of N in the 3rd byte. During play, the play mode is immediately changed. 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 | <ul style="list-style-type: none"> When receiving the VOL+ command, the LSI controls the sound volume step by incrementing by 1. |

| | | | | | | |
|--------|---|------|------|------|------|--|
| | | | | | | <ul style="list-style-type: none"> The sound volume is controlled in 32 steps from $-\infty$ (minimum volume) to 0 dB (maximum volume). |
| VOL- | 4 | 0x61 | 0x06 | 0x02 | 0x00 | <ul style="list-style-type: none"> When receiving the VOL- command, the LSI controls the volume step by decrementing by 1. The sound volume is controlled in 32 steps from $-\infty$ (minimum volume) to 0 dB (maximum volume). |
| REPEAT | 4 | 0x61 | 0x06 | 0x03 | 0x00 | <ul style="list-style-type: none"> This command changes the mode for repeat. REPEAT command toggles as: memory repeat \rightarrow 1 music repeat \rightarrow 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 | <ul style="list-style-type: none"> 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 \rightarrow 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 folder in a status where "repeat within the memory" 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 | <ul style="list-style-type: none"> 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 folder in the status where "repeat within the memory" 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 I²S (32fs) format. N=0x03: Outputs in I²S (48fs) format. N=0x04: Outputs in I²S (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: "Analog line output" is set. |

| | | | | | | |
|----------|---|------|------|----------|---|---|
| SET_EQ | 4 | 0x61 | 0x10 | 0x0 1 | N | <ul style="list-style-type: none"> 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 | 0x0 2 | N | <ul style="list-style-type: none"> 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 | 0x0 3 | N | <ul style="list-style-type: none"> 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 | 0x0 4 | N | <ul style="list-style-type: none"> • 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. |
| SET_TAG | 4 | 0x61 | 0x10 | 0x0 5 | N | <ul style="list-style-type: none"> • 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 | 0x0 6 | N | <ul style="list-style-type: none"> • 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. |

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| SET_PRM | 8 | 0x61 | 0x10 | 0x07 | L | <ul style="list-style-type: none"> • 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. <p>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.</p> <ul style="list-style-type: none"> • Play time is set to M[15:0]= [6th byte, 5th byte], and skip time to N[15:0]= [8th byte, 7th byte]. <p>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].</p> <p>Specifying 0x0 sets the default.</p> <p>Set play time to 300ms or more, and skip time to (play time×16) or less.</p> <ul style="list-style-type: none"> • 0xL in the 4th byte sets the attenuation level during fast forward and rewind. The allowable level is -6dB X[4th byte]. <p>Allowable setting range is from 0x00 to 0x10.</p> <p>By default, 0x02=-12dB is set. Setting of 0x10 is equivalent to MUTE.</p> |
| BROWSING | | | | | | |
| ANALYZE_ROOT | 4 | 0x62 | 0x00 | 0x00 | 0x00 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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. |
| GET_PATH_CURSOR | 4 | 0x62 | 0x01 | 0x03 | 0x00 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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. |
| MOV_NEXT | 4 | 0x62 | 0x02 | 0x01 | N | <ul style="list-style-type: none"> • 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. |

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| MOV_PREV | 4 | 0x62 | 0x02 | 0x02 | N | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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. 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> This command selects the play list file by full path and file name. The full path is 256 bytes at maximum (including drive letter (A:\), file name and extension). Set this at the 5th-260th bytes. 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. In this case, the length is 253 bytes at maximum. If the full path has a drive letter different from the one for the memory being selected, an error occurs. (For example, "B:\": is set |

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| | | | | | | <p>for the full path when USB is selected.)</p> <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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. • 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 | <ul style="list-style-type: none"> • 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. |
| PLST_PLAY_CURSOR | 4 | 0x62 | 0x13 | 0x00 | 0x00 | <ul style="list-style-type: none"> • 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. |
| PLST_GET_TAG_CURSOR | 4 | 0x62 | 0x13 | 0x01 | 0x00 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | | | | | | |

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| FOPEN_R | 260 | 0x63 | 0x01 | 0x00 | 0 | <ul style="list-style-type: none"> 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 full path is 256 bytes at maximum (including drive letter (A:\), file name and extension). Set this at the 5th-260th bytes. 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. In this case, the length is 253 bytes at maximum. If the full path has a drive letter different from the one for the memory being selected, an error occurs. (For example, "B:" is set for the full path when USB is selected.) |
| FOPEN_R_CURSOR | 4 | 0x63 | 0x01 | 0x01 | 1 | <ul style="list-style-type: none"> 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. |
| FOPEN_R_DIRECT | 10 | 0x63 | 0x01 | 0x02 | 2 | <ul style="list-style-type: none"> 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. If a file exists after receiving the command, open the specified file. |
| FOPEN_W | 266 | 0x63 | 0x02 | 0x00 | 0 | <ul style="list-style-type: none"> 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 full path is 256 bytes at maximum (including drive letter (A:\), file name and extension). Set this at the 11th-266th bytes. 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. In this case, the length is 253 bytes at maximum. If the full path has a drive letter different from the one for the memory being selected, an error occurs. (For example, "B:" is set for the full path when USB is selected.) 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. |
| FCLOSE | 4 | 0x63 | 0x03 | 0x00 | 0 | <ul style="list-style-type: none"> This command closes the file. After the File Read/Write function is completed, CLOSE the file. |
| SET_FRW_BUS | 4 | 0x63 | 0x04 | N | M | <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> M=0x00: Uses SPI mode 0. M=0x01: Uses SPI mode 1. M=0x02: Uses SPI mode 2. M=0x03: Uses SPI mode 3. |

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| | | | | | | <ul style="list-style-type: none"> By default, N=0x00: "Uses the I²C bus" is set (M=0x00). |
| FWRITE_DAT | 4/260 | 0x63 | 0x05 | N | N | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> This command deletes the file or folder specified by the full path. The full path is 256 bytes at maximum (including drive letter (A:\), file name and extension). Set this at the 5th-260th bytes. 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. In this case, the length is 253 bytes at maximum. If the full path has a drive letter different from the one for the memory being selected, an error occurs. (For example, "B:\\" is set for the full path when USB is selected.) 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. |
| FDEL_CURSOR | 4 | 0x63 | 0x07 | 0x01 | 0x00 | <ul style="list-style-type: none"> 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. |
| CD-DA | | | | | | |

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| START_ENCODE | 261 | 0x64 | 0x01 | 0x00 | 0 | <ul style="list-style-type: none"> 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 full path is 251 bytes at maximum (including drive letter (A:\), file name, and extension). Set this at the 11th-261st bytes. If the length is less than 251 bytes, insert 0x00 at the end. Insert "\"(0x5C) for the delimiter between folder layers. If the specified folder does not exist, it should be created. The drive letter is "A:" for USB and "B:" for SD. You can also specify the path in a format without drive letter. In this case, the length is 248 bytes at maximum. If the full path has a drive letter different from the one for the memory being selected, an error occurs. (For example, "B:" is set for the full path when USB is selected.) 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 | 4 | 0x64 | 0x02 | 0x00 | N | <ul style="list-style-type: none"> 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 | 4 | 0x64 | 0x03 | 0x00 | N | <ul style="list-style-type: none"> 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 | 4 | 0x64 | 0x04 | N | M | <ul style="list-style-type: none"> 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.) By default, N=0x00: "Writes to MP3 external memory (USB,SD)", |

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| | | | | | | <p>and M=0x00: "Does not play" are set.</p> <ul style="list-style-type: none"> Do this setting before opening the encode file (before START_ENCODE). Any change made after opening the file will not be accepted. |
| SET_ENCODE_P RM | 8 | 0x64 | 0x05 | N | M | <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> N=0x00: Inputs in I²S (32 fs) format. N=0x01: Inputs in I²S (48 fs) format. N=0x02: Inputs in I²S (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. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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_TA G | 68 | 0x64 | 0x06 | N | M | <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> M=0x00: Inputs in I²S (32fs) format. M=0x01: Inputs in I²S (48fs) format. M=0x02: Inputs in I²S (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 | <ul style="list-style-type: none"> • 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. • When the LSI is playing or copying a CD-ROM file, the command forcibly stop the operation. |
| START_CDANA | 4 or 8 | 0x65 | 0x01 | 0x02 | 0x00 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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, N=0x03:AAC , N=0x04:WAV 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. |

Table 7.1.2 Command enable/disable in each system operation mode

| Command | Command enable/disable in each system operation mode | | | | | | | Command enable/disable in each status | | | | | | |
|------------------|--|-------|--------|----------|----------|-------|--------|---------------------------------------|------|---------------|---------------|---------|-------|-------|
| | CONFIG | PLAYR | FILERW | PLAYLIST | IPLWRITE | 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_IPL_UNIT | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | × | ○ | ○ | × | × | ○ |
| 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 | x | o | o | o | x | x | x | o | o | x | o | x | x | x |
| PLAY_CURSOR | x | o | x | x | x | x | x | o | o | x | x | x | x | x |
| GET_TAG_CURSOR | x | o | x | x | x | x | x | o | o | x | o | x | x | x |
| GET_PATH_CURSOR | x | o | o | o | x | x | x | o | o | x | o | x | x | x |
| PLAY_DIRECT | x | o | x | x | x | x | x | o | o | x | x | x | x | x |
| MOV_NEXT | x | o | o | o | x | x | x | o | o | x | o | x | x | x |
| MOV_PREV | x | o | o | o | x | x | x | o | o | x | o | x | x | x |
| MOV_UP | x | o | o | o | x | x | x | o | o | x | o | x | x | x |
| MOV_DOWN | x | o | o | o | x | x | x | o | o | x | o | x | x | x |
| MOV_HOME | x | o | o | o | x | x | x | o | o | x | o | x | x | x |
| MOV_PLAYING | x | o | x | x | x | x | x | x | o | x | x | x | x | x |
| MOV_DIRECT | x | o | x | o | x | x | x | o | o | x | o | x | x | x |
| SET_EXTENSION | x | o | o | o | x | x | o | o | o | o | o | x | x | x |
| PLAYLIST | | | | | | | | | | | | | | |
| SET_PLAYLIST | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| SET_PLAYLIST_DIRECT | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| SET_PLAYLIST_CURSOR | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| PLST_PLAY_CURSOR | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| PLST_GET_TAG_CURSOR | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| PLST_MOV_NEXT | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| PLST_MOV_PREV | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| PLST_MOV_HOME | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| PLST_MOV_PLAYING | x | x | x | o | x | x | x | o | o | x | x | x | x | x |
| FILE RW | | | | | | | | | | | | | | |
| FOPEN_R | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| FOPEN_R_CURSOR | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| FOPEN_R_DIRECT | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| FOPEN_W | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| FCLOSE | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| SET_FRW_BUS | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| FWRITE_DAT | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| FREAD_DAT | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| FDEL | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| FDEL_CURSOR | x | x | o | x | x | x | x | o | x | x | x | x | x | x |
| CD-DA | | | | | | | | | | | | | | |
| START_ENCODE | x | x | x | x | x | o | x | o | x | x | x | x | x | x |
| STOP_ENCODE | x | x | x | x | x | o | x | o | o | o | x | o | o | x |
| SET_COMP_MODE | x | x | x | x | x | o | x | x | o | x | x | x | x | x |
| SET_ENCODE_MODE | x | x | x | x | x | o | x | o | x | x | x | x | x | x |
| SET_ENCODE_PRIM | x | x | x | x | x | o | x | o | x | x | x | x | x | x |
| SET_ENCODE_TAG | x | x | x | x | x | o | x | o | x | x | x | x | x | x |
| CD-ROM | | | | | | | | | | | | | | |
| START_CDROM | x | x | x | x | x | x | o | o | x | x | x | x | x | x |
| STOP_CDROM | x | x | x | x | x | x | o | o | o | o | o | o | x | x |
| START_CDANA | x | x | x | x | x | x | o | o | o | x | x | x | x | x |
| STOP_CDANA | x | x | x | x | x | x | o | o | o | x | x | x | x | x |

| | | | | | | | | | | | | | | |
|------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CD_SET_VD | x | x | x | x | x | x | o | o | x | x | x | x | x | x |
| CD_SET_LBN | x | x | x | x | x | x | o | o | o | x | x | x | x | x |

O=enable x=disable

7.2 Status output

The operation information, such as internal statuses, play time, folders, files and Tags, is output using a I²C interface.

The statuses shown in Table 7.2.1 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 7.2.2 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 7.2.1 Status Register Map

| OFFSE T | 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_INF O | | INIT_END | PRECOM | RES_ERR | DEC_ERR |
| 0x02 | STATUS3 | USBINS | SDINS | USBFILE | SDFILE | MDEVUS B | MDEVSD | PDEVUSB | PDEVSD |
| 0x03 | STATUS4 | SEL_TOC | TINFUSB | TINFSD | SET_TAG | ANA_TAG | TAGINFO | | |
| 0x04 | STATUS5 | 0 | SEL_USB SD | FBP | FFP | PLAYFILE | | | |
| 0x05 | STATUS6 | PRECOM STAT | | | | | | | |
| 0x06 | VOLINF | 0 | 0 | 0 | VOLINF | | | | |
| 0x07 | DOUTINF | | EQINF | | | | DOUTINF | | |
| 0x08 | PMODEINF | | REPEATI NF | | | | SETNEXTI NF | | |
| 0x09 | SEL_MP3 | 0 | 0 | 0 | 0 | WDT_RFL G | 12MOUT | SET_SOR T | 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 | PFILENLL | | PFILENLL | | | | | | |
| 0x15 | PFILENLH | | PFILENLH | | | | | | |
| 0x16 | PFILENHL | | PFILENHL | | | | | | |
| 0x17 | PFILENFHH | | PFILENFH H | | | | | | |
| 0x18 | PFILENMLL | | PFILENMLL | | | | | | |
| 0x19 | PFILENMLH | | PFILENMLH | | | | | | |
| 0x1A | PFILENMHL | | PFILENMHL | | | | | | |
| 0x1B | PFILENMHH | | PFILENMH H | | | | | | |
| 0x1C | TFOLMEML | | TFOLMEM L | | | | | | |
| 0x1D | TFOLMEMH | | TFOLMEM H | | | | | | |
| 0x1E | TFILEMEMLL | | TFILEME MLL | | | | | | |
| 0x1F | TFILEMEMLH | | TFILEME MLH | | | | | | |

| | | | | | | | | | |
|-----------------|-------------------|--------------------|---------------------|------------------|------------------|-----------------|---------------|------------------|-----------------|
| 0x20 | TFILEMEMHL | TFILEME MHL | | | | | | | |
| 0x21 | TFILEMEMHH | TFILEME MHH | | | | | | | |
| 0x22 | BROWSESTA T | ANA_ERR | 0 | GET_PAT H_END | GET_TAG _END | GET_TAG_ID | | ANA_CUR | |
| 0x23 | NUMANAFOLL L | NUMANAF OLLL | | | | | | | |
| 0x24 | NUMANAFOLL H | NUMANAF OLLH | | | | | | | |
| 0x25 | NUMANAFOL HL | NUMANAF OLHL | | | | | | | |
| 0x26 | NUMANAFOL HH | NUMANAF OLHH | | | | | | | |
| 0x27 | TFILEANAFOL LL | TFILEANA FOLL | | | | | | | |
| 0x28 | TFILEANAFOL LH | TFILEANA FOLLH | | | | | | | |
| 0x29 | TFILEANAFOL HL | TFILEANA FOLHL | | | | | | | |
| 0x2A | TFILEANAFOL HH | TFILEANA FOLHH | | | | | | | |
| 0x2B | TFOLANAFOL L | TFOLANA FOLL | | | | | | | |
| 0x2C | TFOLANAFOL H | TFOLANA FOLH | | | | | | | |
| 0x2D | TFOLANAHEI RL | TFOLANA FOLL | | | | | | | |
| 0x2E | PLISTPLAY | PLIST_GT AG_END | PLIST_TA G_EXIST | PLIST_BR _ERR | PLIST_BR _BSY | PLISTERR | 0 | PLISTOPE N | PLISTPLA Y |
| 0x2F | FIOSTAT | FIOERR | 0 | FIORW | FIOOPEN | FRDREAD Y | FWRREA DY | FIOSEAR CH | FIOMODE |
| 0x30 | FIOSET | FIOBUS | | FIOSPMD | | FIOOPE | | | |
| 0x31 | IPLWMODE | 0 | IPLWUNIT | IPLWMOD EACT | IPLWMOD EEND | IPLWEER R | IPLWEXIS T | IPLSERC H | IPLWMOD E |
| 0x32 | ENCON | ENCERR | 0 | ENCEND | ENCCLOS E | MEMACC | ENC | ENCSEAR CH | ENCON |
| 0x33 | COMPON | TAGW | ENCMP3 | ENCMEM W | ENCMEM | 0 | COMPOP E2 | COMPOP E 1 | COMPON |
| 0x34 | ENC_PLAY | ENC_INF ORM | | | | ENC_PLA Y | | | |
| 0x35 | ENC_BITRATE | ENC_INS R | | | | ENC_BITR ATE | | | |
| 0x36 | CDROMON | 0 | 0 | SEEK | CDROMA NAERR | CDROMA NAEND | | CDROMA NABUSY | CDROMO N |
| 0x37 | MEMINFO | MEMINFO | | | | 0 | 0 | IRPTOINT | IRPTODE VICE |
| 0x38 - 0x13F | COMAREA | COMARE A | | | | | | | |

| OFFSE T | 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 |
| 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 | PRECOMSTA T | 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 | PFILENLL | 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 | PFILENLH | 7:0 | PFILENLH | Playing file number in the present folder. [15:0], Higher rank byte | [15:8] |
| 0x16 | PFILENHL | 7:0 | PFILENHL | Playing file number in the present folder. [31:16], Low rank byte | [23:16] |
| 0x17 | PFILENH | 7:0 | PFILENH | Playing file number in the present folder. [31:16], Higher rank byte | [31:24] |
| 0x18 | PFILENMLL | 7:0 | PFILENMLL | Playing file number in the memory. [15:0] Low rank byte | [7:0] |
| 0x19 | PFILENMLH | 7:0 | PFILENMLH | Playing file number in the memory. [15:0] Higher rank byte | [15:8] |
| 0x1A | PFILENMHL | 7:0 | PFILENMHL | Playing file number in the memory. [31:16] Low rank byte | [23:16] |
| 0x1B | PFILENMHH | 7:0 | PFILENMHH | 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 | 7:0 | TFILEMEML | The number of total files in memory. [15:0] low-rank byte | [7:0] |
| 0x1F | TFILEMEMH | 7:0 | TFILEMEMH | The number of total files in memory. [15:0] higher-rank | [15:8] |
| 0x20 | TFILEMEML | 7:0 | TFILEMEML | The number of total files in memory. [31:16] low-rank byte | [23:16] |
| 0x21 | TFILEMEMH | 7:0 | TFILEMEMH | 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 | NUMANAFOLL | 7:0 | NUMANAFOLL | 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 | NUMANAFOLH | 7:0 | NUMANAFOLH | Cursor position number in a cursor existence folder | [15:0] Higher rank byte [15:8] |
| 0x25 | NUMANAFOLHL | 7:0 | NUMANAFOLHL | Cursor position number in a cursor existence folder | [31:16] Low rank byte [23:16] |
| 0x26 | NUMANAFOLHH | 7:0 | NUMANAFOLHH | Cursor position number in a cursor existence folder | [31:16] Higher rank byte [31:24] |
| 0x27 | TFILEANAFOLL | 7:0 | TFILEANAFOLL | The number of files total in a cursor existence folder | [15:0] Low rank byte [7:0] |
| 0x28 | TFILEANAFOLH | 7:0 | TFILEANAFOLH | The number of files total in a cursor existence folder | [15:0] Higher rank byte [15:8] |
| 0x29 | TFILEANAFOLHL | 7:0 | TFILEANAFOLHL | The number of files total in a cursor existence folder | [31:16] Low rank byte [23:16] |
| 0x2A | TFILEANAFOLHH | 7:0 | TFILEANAFOLHH | The number of files total in a cursor existence folder | [31:16] Higher rank byte [31:24] |

| | | | | |
|------|--------------|-----|-----------------|---|
| 0x2B | TFOLANAFOLL | 7:0 | TFOLANAFOLL | The number of subfolders total in a cursor existence folder [15:0] Low rank byte [7:0] |
| 0x2C | TFOLANAFOLH | 7:0 | TFOLANAFOLH | The number of subfolders total in a cursor existence folder [15:0] Higher rank byte [15:8] |
| 0x2D | TFOLANAHEIRL | 7:0 | TFOLANAHEIRL | The classes number of cursor existence folder [7:0] A ROOT class is set to 1. |
| 0x2E | PLISTPLAY | 7 | PLIST_GTAG_END | TAG analysis situation on Browsing cursor position in Play LIST 0: Under TAG un-analyzing / analysis , 1:End of TAG analysis |
| | | 6 | PLIST_TAG_EXIST | 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 |
| | | 4 | PLIST_BR_BUSY | 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: I ² C, 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 | IPLWUNIT | IPL FLASH ROM rewriting unit setup. 0;Page unit, 1;Byte unit |
| | | 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 | 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 | 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 | 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_BITRATE | 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 | CDROMANAE RR | CD-ROM file analysis error situation 0;no Error, 1: with Error |
| | | 3:2 | CDROMANAE ND | CD-ROM file analysis end situation 0;Un-analyzing, 2: Analysis end |
| | | 1 | CDROMANAB USY | 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 | 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) |
| - 0x13F | | | | |

Table 7.2.2 Status Output Commands

| Command name | Command Byte length | Command | | | | Status The number of output bytes | STATUS |
|-----------------|------------------------|---------|------|------|------|--------------------------------------|---|
| | | 1st | 2nd | 3rd | 4th | | |
| READ_BUFF | 4 | 0x6C | 0x00 | N | M | Arbitrary | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Output about internal status. Output about OFFSET 0x00-0x05 of a status buffer. |
| READ_PSET | 4 | 0x6D | 0x00 | 0x01 | 0x00 | 4 | <ul style="list-style-type: none"> Output about setting information. Output about OFFSET 0x06-0x09 of a status buffer. |
| READ_PTIME | 4 | 0x6D | 0x00 | 0x02 | 0x00 | 6 | <ul style="list-style-type: none"> Output about Playing time information. Output about OFFSET 0x0A-0x0F of a status buffer. |
| READ_LANG | 4 | 0x6D | 0x00 | 0x02 | 0x01 | 2 | <ul style="list-style-type: none"> Output about TAG character code information. Output about OFFSET 0x10-0x11 of a status buffer. |
| READ_PNUM | 4 | 0x6D | 0x00 | 0x02 | 0x02 | 10 | <ul style="list-style-type: none"> Output about the number under Playing. Output about OFFSET 0x12-0x1B of a status buffer. An exact value cannot be acquired when music is specified by cursor and access data, such as a PLAY_CURSOR command. |
| READ_TNUM | 4 | 0x6D | 0x00 | 0x02 | 0x03 | 6 | <ul style="list-style-type: none"> Output about the file in a memory, and the number of folders. Output about OFFSET 0x1C-0x21 of a status buffer. |
| READ_FNUM | 4 | 0x6D | 0x00 | 0x02 | 0x04 | 4 | <ul style="list-style-type: none"> Output the number of files which is in a folder during the present Playing. |
| READ_PFILE_NAME | 4 | 0x6D | 0x00 | 0x03 | N | 130 | <ul style="list-style-type: none"> 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 |

| | | | | | | | |
|------------------------|---|------|------|------|------|-----|---|
| | | | | | | | <ul style="list-style-type: none"> Output data has the preposed data ID (2 bytes). See 6.3.7 for the output format. |
| READ_PFOL_NAME | 4 | 0x6D | 0x00 | 0x04 | 0x00 | 130 | <ul style="list-style-type: none"> Output the folder name of the file being played. Output data has the preposed data ID (2 bytes). See 6.3.7 for the output format. |
| READ_PFILE_TAG | 4 | 0x6D | 0x00 | 0x05 | N | 130 | <ul style="list-style-type: none"> 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 preposed data ID (2 bytes). See 6.3.7 for the output format. |
| READ_RESUME_INFO | 4 | 0x6D | 0x00 | 0x06 | 0x00 | 42 | <ul style="list-style-type: none"> Outputs the data required to execute resume play. The data is output in Little Endian format. |
| READ_DEV_FREE | 4 | 0x6D | 0x00 | 0x07 | N | 8 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Output a Device Descriptor value when the USB memory is inserted and chosen. |
| READ_CONDESC | 4 | 0x6D | 0x00 | 0x08 | 0x01 | 32 | <ul style="list-style-type: none"> Output a Configuration Descriptor value when the USB memory has been recognized. |
| READ_INQUIRY | 4 | 0x6D | 0x00 | 0x08 | 0x02 | 36 | <ul style="list-style-type: none"> Output a MSC Inquiry value when the USB memory has been recognized. |
| READ_BROWSE_STATUS | 4 | 0x6D | 0x01 | 0x00 | 0x00 | 1 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Output about the cursor position number of browsing in a memory. Output about OFFSET 0x23-0x26 of a status buffer. |
| READ_BROWSE_TNUM | 4 | 0x6D | 0x01 | 0x00 | 0x02 | 7 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Outputs the information on the folder where the entry being pointed by the memory browsing cursor resides. See 6.4 for the output format. |
| READ_BROWSE_ENTRY_INFO | 4 | 0x6D | 0x01 | 0x02 | N | 76 | <ul style="list-style-type: none"> 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. See 6.4 for the output format. |
| READ_BROWSE_TAG | 4 | 0x6D | 0x01 | 0x03 | N | 130 | <ul style="list-style-type: none"> 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 preposed data ID (2 bytes). See 6.4 for the output format. |
| READ_BROWSE_PATH | 4 | 0x6D | 0x01 | 0x04 | 0x00 | 258 | <ul style="list-style-type: none"> 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 preposed data ID (2 bytes). See 6.4 for the output format. |
| READ_PLIST_STATUS | 4 | 0x6D | 0x02 | 0x00 | 0x00 | 1 | <ul style="list-style-type: none"> Output about play list mode status. Output about OFFSET 0x2E-0x31 of a status buffer. |

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|----------------------|---|------|------|------|------|-----|--|
| READ_PLIST_TAG | 4 | 0x6D | 0x02 | 0x01 | N | 130 | <ul style="list-style-type: none"> 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 preposed data ID (2 bytes). See 6.4 for the output format. |
| READ_PLIST_PATH | 4 | 0x6D | 0x02 | 0x02 | N | 258 | <ul style="list-style-type: none"> 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 preposed data ID (2 bytes). See 6.4 for the output format. 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 | <ul style="list-style-type: none"> Outputs the name of the Nth file ahead from the entry pointed by the play list browsing cursor. Output data has the preposed data ID (2 bytes). See 6.4 for the output format. 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 | <ul style="list-style-type: none"> 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 preposed data ID (2 bytes). See 6.4 for the output format. 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 | <ul style="list-style-type: none"> Outputs the name of the Nth file ahead from the entry being played. Output data has the preposed data ID (2 bytes). See 6.4 for the output format. 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 | <ul style="list-style-type: none"> Outputs the currently set number of files within the play list. |
| READ_PLIST_PNUM | 4 | 0x6D | 0x02 | 0x07 | 0x00 | 4 | <ul style="list-style-type: none"> Outputs the currently set cursor position within the play list. |
| | | | | | | | |
| READ_FR_STATUS | 4 | 0x6D | 0x03 | 0x00 | 0x00 | 2 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Output about IPL Write status. Output about OFFSET 0x31-x34 of a status buffer. |
| | | | | | | | |
| READ_ENC_STATUS | 4 | 0x6D | 0x06 | 0x00 | 0x00 | 4 | <ul style="list-style-type: none"> Output about Encode mode status. Output about OFFSET 0x32-0x35 of a status buffer. |
| READ_ENC_FILEPATH | 4 | 0x6D | 0x06 | 0x01 | 0x00 | 258 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> Output about CD-ROM mode status. Output about OFFSET 0x36 of a status buffer. |
| READ_CD_SLBN | 4 | 0x6D | 0x07 | 0x01 | 0x00 | 4 | <ul style="list-style-type: none"> Output about the LBN number demanded by SEEK request. Output by LittleEndian. |
| READ_CD_PLBN | 4 | 0x6D | 0x07 | 0x01 | 0x01 | 4 | <ul style="list-style-type: none"> Output about the LBN number of the present input data. Output by LittleEndian. |
| READ_CD_FINUM | 4 | 0x6D | 0x07 | 0x01 | 0x02 | 6 | <ul style="list-style-type: none"> 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 'READ_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 | <ul style="list-style-type: none"> • 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 'READ_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 | <ul style="list-style-type: none"> • Output about the present memory information. • Output about OFFSET 0x37 of a status buffer. |
| READ_CKSUM | 4 | 0x6D | 0x0A | 0x03 | 0x00 | 5 | <ul style="list-style-type: none"> • Output the CHECK SUM calculation result when IPL download. • Output a 1st byte= comparison result. When the 1st byte is 0x0, it show that comparison result is coincidence. When the 1st byte is 0x1, it show 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 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 | <ul style="list-style-type: none"> • 5th-10th byte = it is 0x88 0xF3 0x03 0x10 0x01 0x00 is specified. • Outputted internal stop status. |
| READ_MEMORY 1 | 10 | 0x6D | 0xFE | 0x00 | 0x00 | 4 | <ul style="list-style-type: none"> • 5th-10th byte = it is 0x08 0x69 0x00 0x10 0x04 0x00 is specified. • Outputted internal FFP status. |
| READ_FW_VER | 4 | 0x6D | 0xFF | 0x00 | 0x00 | 4 | • Output about a firmware version. |
| READ_IPL_VER | 4 | 0x6D | 0xFF | 0x01 | 0x00 | 12 | <ul style="list-style-type: none"> • Output about the image version in Flash. • 1st-2nd byte= model number "W2"=0x57 0x32, 3th-4th= year (lower 2 figures), 5th-8th= manufacture days and months, and 9th-12th="FLAS"=0x46 0x4C 0x41 0x53 is outputted. |

Table 7.2.3 Command enable/disable in each system operation mode

| Command | Command enable/disable in each system operation mode | | | | | | | Command enable/disable in each status | | | | | | |
|------------------------|--|------------|------------|--------------|--------------|-----------|------------|---------------------------------------|------|----------------------------|----------------------|-------------|-------|-----------|
| | CONFIG | PLAYE R | FILE RW | PLAYL IST | IPL WRITE | CD-D A | CD-R OM | STOP | PLAY | SEAR CH (device) | SEAR CH (FILE) | Analy ze | Write | ERRO R |
| 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_BROWSE_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 | x | x | x | ○ | x | x | x | ○ | ○ | x | x | x | x | x |
| READ_PLIST_PNUM | x | x | x | ○ | x | x | x | ○ | ○ | x | x | x | x | x |
| READ_FR_STATUS | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_FR_SIZE | x | x | ○ | x | x | x | x | ○ | x | x | x | x | x | x |
| READ_FR_DATA | x | x | ○ | x | x | x | x | ○ | x | x | x | x | x | x |
| READ_IPL_STATUS | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_ENC_STATUS | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_ENC_FILEPATH | x | x | x | x | x | ○ | x | ○ | ○ | x | x | x | ○ | x |
| READ_CD_STATUS | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_CD_SLBN | x | x | x | x | x | x | ○ | ○ | ○ | x | x | x | x | x |
| READ_CD_PLBN | x | x | x | x | x | x | ○ | ○ | ○ | x | x | x | x | x |
| READ_CD_FINUM | x | x | x | x | x | x | ○ | ○ | ○ | x | x | x | x | x |
| READ_CD_FONUM | x | x | x | x | x | x | ○ | ○ | ○ | x | x | x | x | x |
| READ_CD_FILE | x | x | x | x | x | x | ○ | ○ | ○ | x | x | x | x | x |
| READ_CD_FOL | x | x | x | x | x | x | ○ | ○ | ○ | x | x | x | x | x |
| READ_SYSMODE | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_MEMINFO | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_CKSUM | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_MOUNT_ERROR | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_BFULLO | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_STOPST1 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_STOPST2 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_MEMORY1 | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_FW_VER | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| READ_IPL_VER | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |

○=enable x=disable

•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 2X speed recording
Recording to a memory with slow access speed may require data connection operation.
2X speed 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 I²C format I/F
Although this LSI has adopted the I²C 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.

●Ordering part number

| | |
|---|---|
| B | U |
|---|---|

Part No.

| | | | | | |
|---|---|---|---|---|---|
| 9 | 4 | 7 | 0 | 2 | A |
|---|---|---|---|---|---|

Part No.

| | |
|---|---|
| K | V |
|---|---|

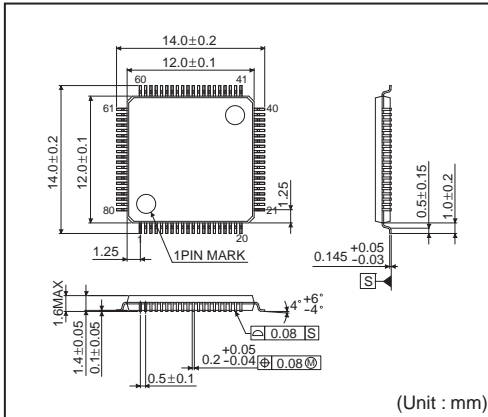
 Package
 KV:
 VQFP80

| | |
|---|---|
| E | 2 |
|---|---|

 Packaging and forming
 specification
 E2: Embossed tape and
 reel
 None: Tray, Tube

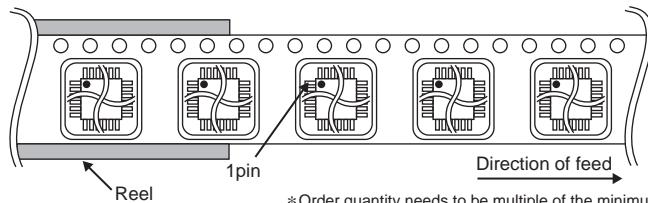
●Physical Dimension Tape and Reel Information

VQFP80

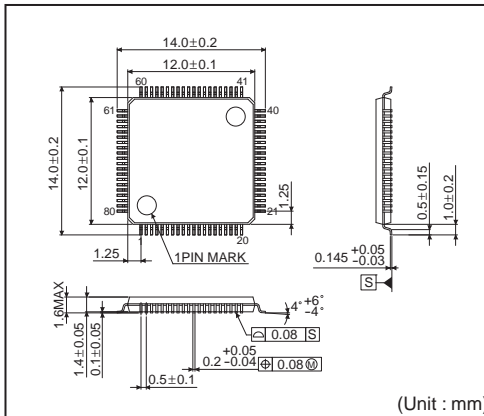


<Tape and Reel information>

| | |
|-------------------|---|
| 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) |

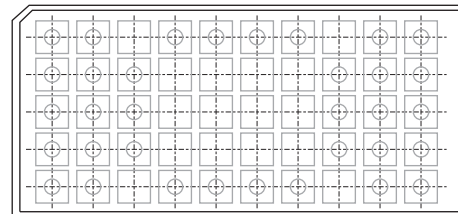
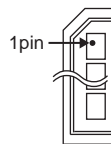


VQFP80



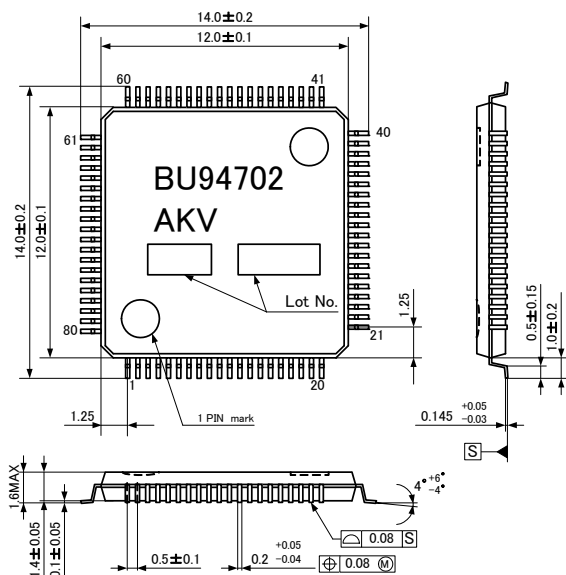
<Tape and Reel information>

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



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

●External dimension



●Revision history

| Date | Revision | Changes |
|-------------|----------|---|
| 01.Apr.2012 | A | New Release |
| 29.Jun.2012 | B | <p>MODE1 Function description delete</p> <p>P9 SD I/F Timing add</p> <p>P10 Audio line output Timing add</p> <p>P12 Digital audio output Timing add</p> <p>P14 SPDIF output Timing add</p> <p>P19 BUSY,MCHNG,SEARCH,IRPTO The description used for a microcomputer connecting add</p> <p>P25 File search Maximum Playable mistake correct Root folder=65535->65535</p> <p>P28 6.3.2.2 WMA sample rates mistake correct 12,24kHz delete</p> <p>P34 File browsing within memory description add</p> <p>P42 A command is moved to Chapter 7.</p> <p>P60,63 ENCON. BFULLO (offset=0x32. Bit 5) status delete</p> <p>P66 READ_BFULLO,READ_STOPST1,READ_STOPST2,READ_MEMORY1 command add</p> |

Notes

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