

- ◇Structure Silicon Monolithic integrated circuit
- ◇Product name USB host MP3 Decoder LSI
- ◇Type BU9435KV
- ◇Applications Audio products, etc.
- ◇Functions BU9435KV is MP3 decoder IC which contains USB host and SD card I/F, audio DAC, system controller.
 - USB2.0 Full Speed host I/F function contained.
 - SD card I/F function contained.
 - I²C I/F function contained.
 - FAT analysis function contained.
 - MP3 decode function contained. (available for MPEG1, 2 and 2.5, Layer 1, 2 and 3)
 - Sample Rate Converter contained.
 - System Controller contained.
 - LED Controller contained.
 - KEY matrix Controller contained.
 - Stand Alone mode contained.
 - External processor can control.
 - Audio DAC contained.
 - Sound Effect function contained.
 - Digital Audio Out(I²S, S/PDIF) function contained.
 - File Name, Folder Name Sorting.
 - ID3TAG Analysis.
 - VQFP64pin(0.5mm pitch)

◇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 |
| Supply voltage(CORE) | VDD2MAX | -0.3~2.1 | V | DVDD |
| 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 | 750 | 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 |
| Supply voltage(CORE) | VDD2 | 1.4~1.6 | V | DVDD |


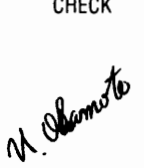
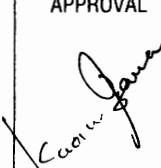
MPEG Layer-3 audio decoding technology licensed from Fraunhofer IIS and Thomson.

Status of this document

The Japanese version of this document is the formal specification. A customer may use this translation version only for a reference to help reading the formal version. If there are any differences in translation version of this document, formal version takes priority.

Application example

- ROHM cannot provide adequate confirmation of patents.
- The product described in this specification is designed to be used with ordinary electronic equipment or devices (such as audio-visual equipment, office-automation equipment, communications devices, electrical appliances, and electronic toys).
Should you intend to use this product with equipment or devices which require an extremely high level of reliability and the malfunction of which would directly endanger human life (such as medical instruments, transportation equipment, aerospace machinery, nuclear-reactor controllers, fuel controllers and other safety devices), please be sure to consult with our sales representative in advance.
- ROHM assumes no responsibility for use of any circuits described herein, conveys no license under any patent or other right, and makes no representations that the circuits are free from patent infringement.

| | | | | |
|---|--|---|-------------------|---|
| DESIGN  | CHECK  | APPROVAL  | DATE: 12/Mar/2007 | SPECIFICATION No. : TSZ02201-BU9435KV-1-2 |
| | | | REV. A | ROHM CO., LTD. |

◇Electrical characteristics

(Unless specified, Ta=25°C, VDD1=3.3V, VDD2=1.5V, DVSS=AVSSC=VSS_PLL=DAVSS=0V, XIN_PLL=16.9344MHz)

| Parameter | Symbol | Limits | | | Unit | Condition |
|--------------------------------|---------|----------|--------|----------|------|-------------------------------|
| | | MIN. | TYP. | MAX. | | |
| <Total > | | | | | | |
| Circuit current (VDD1 USB) | IDD1USB | - | 22.0 | 50.0 | mA | *1 When USB memory is played. |
| Circuit current (VDD1 SD) | IDD1SD | - | 3.2 | 8.0 | mA | *1 When SD card is played. |
| Circuit current (VDD2 USB) | IDD2USB | - | 24.0 | 40.0 | mA | *2 When USB memory is played. |
| Circuit current (VDD2 SD) | IDD2SD | - | 15.4 | 30.0 | mA | *2 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 |
| H-Level output voltage2 | VOH2 | VDD1-0.4 | — | VDD1 | V | IOH=-3.6mA, *5 |
| 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 | 15.0 | 24.8 | kΩ | *8 |
| <Audio DAC> | | | | | | |
| Distortion rate | THD | — | 0.03 | — | % | 1kHz, 0dB, sine, *9 |
| Dynamic range | DR | — | 88 | — | dB | 1kHz, -60dB, sine, *9 |
| S/N ratio | S/N | — | 93 | — | dB | *9 |
| Max output level | VSMAX | — | 0.67 | — | Vrms | 1kHz, 0dB, sine, *9 |

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

*2 1.5V system CORE power supply(VDD2), 1kHz, 0dB, sine-wave playing

*3 1-17, 19-20, 25-26, 40, 49-52, 56, 58-61, 63 pin

*4 10-11, 14-16, 48-55 pin

*5 13 pin

*6 21-23, 26 pin

*7 41 pin

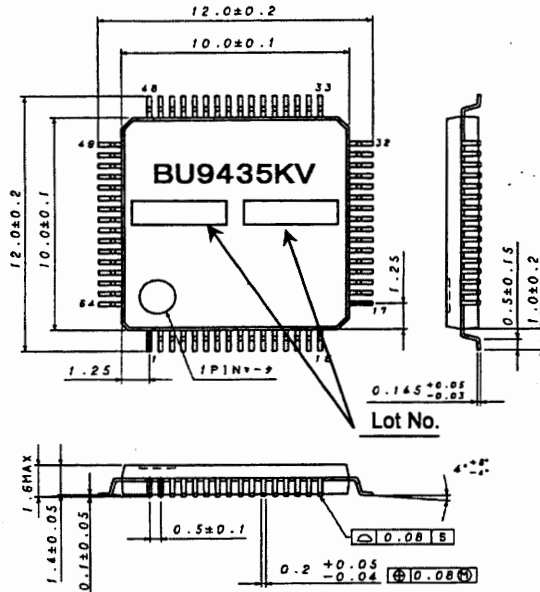
*8 33, 34 pin

*9 44, 46 pin

◇Description of Terminals

| No. | Name | I/O | Description of terminals |
|-----|-------------------|-----|---|
| 1 | RESETX | I | System reset terminal |
| 2 | SEL_SLAVE | I | Slave mode selection (H: Stand Alone mode, L: Slave mode) |
| 3 | SEL_MP3 | I | MPEG Audio Layer selection (H: Only MP3 is playback, L: MP1, MP2 and MP3 can be playback) |
| 4 | SEL_DOUT | I | Digital Audio out selection (H: Disable, L: Enable) |
| 5 | SEL_VOL | I | Volume operation selection (H: Volume+ Effective, L: VOL+-Invalidity) |
| 6 | SEL_APLAY | I | At device(USB,SD) connection, Auto Play mode selection (H: It stop, L: It playback) |
| 7 | SEL_UTPKT | I | USB test packet output selection (H: Normal operation, L: Test packet output) |
| 8 | TEST1 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 9 | TEST2 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 10 | KEY_ROW1/MCHNG | I/O | [KEY_ROW1]KEY Matrix terminal, [MCHNG]Music change flag terminal |
| 11 | KEY_ROW2/BUSY | I/O | [KEY_ROW2]KEY Matrix terminal, [BUSY]Busy flag terminal |
| 12 | KEY_ROW3/SCL | I | [KEY_ROW3]KEY Matrix terminal, [SCL] ² C I/F clock terminal |
| 13 | KEY_ROW4/SDA | I/O | [KEY_ROW4]KEY Matrix terminal, [SDA] ² C I/F data terminal |
| 14 | KEY_COL1/A0 | I/O | [KEY_COL1]KEY Matrix terminal, [A0] ² C Slave address selection |
| 15 | KEY_COL2/A1 | I/O | [KEY_COL2]KEY Matrix terminal, [A1] ² C Slave address selection |
| 16 | KEY_COL3/SEL_SMAN | I/O | [KEY_COL3] KEY Matrix terminal, [SEL_SMAN]Manual mode selection (H: Auto, L: Manual) |
| 17 | TEST3 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 18 | DVDDIO | — | IO Power supply(VDD1) terminal |
| 19 | SD_CON | I | SD card Connect terminal |
| 20 | SD_DO | I | SD card Data In terminal |
| 21 | SD_CLK | O | SD card Clock terminal |
| 22 | SD_DI | O | SD card Data Out terminal |
| 23 | SD_CS | O | SD card Chip select terminal |
| 24 | DVSS | — | GND terminal |
| 25 | TEST4 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 26 | TEST5/CLKTOU12 | O | [TEST5]Pull-up to VDD1 system power supply terminal(TEST PIN), [CLKOUT12]12MHz clock output terminal |
| 27 | DVDD | — | CORE Power supply(VDD2) terminal |
| 28 | TEST6 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 29 | TEST7 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 30 | TEST8 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 31 | ATEST1 | O | USB TEST terminal(TEST PIN) |
| 32 | AVDDC | — | USB Power supply(VDD1) terminal |
| 33 | USB_DM | I/O | USB D- I/O terminal |
| 34 | USB_DP | I/O | USB D+ I/O terminal |
| 35 | AVSSC | — | USB GND terminal |
| 36 | REXTI | O | USB bias resistor(12k Ω) connecting terminal |
| 37 | VOREFI | O | USB TEST terminal(TEST PIN) |
| 38 | VDD_PLL | — | PLL Power supply(VDD1) terminal |
| 39 | TEST_PLL | I | PLL TEST terminal(TEST PIN) |
| 40 | XIN_PLL | I | X'tal(16.9344MHz) connecting input terminal |
| 41 | XOUT_PLL | O | X'tal(16.9344MHz) connecting output terminal |
| 42 | VSS_PLL | — | PLL GND terminal |
| 43 | DAVSS | — | Audio DAC GND terminal |
| 44 | RDACO | O | Audio DAC Rch Line output terminal |
| 45 | VCDACO | O | Audio DAC Reference voltage output terminal |
| 46 | LDACO | O | Audio DAC Lch Line output terminal |
| 47 | DAVDD | — | Audio DAC Power supply(VDD1) terminal |
| 48 | AMUTE | O | Audio Mute output terminal (H: MUTE OFF, L: MUTE ON) |
| 49 | LED_ERROR/TEST9 | O | [LED]Lighting output terminal at ERROR, [TEST9]Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 50 | LED_PLAY/TEST10 | O | [LED]Lighting output terminal at PLAY, [TEST10]Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 51 | LED_PSD/TEST11 | O | [LED]Lighting output terminal at PLAY for SD card, [TEST11]Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 52 | LED_PUSB/TEST12 | O | [LED]Lighting output terminal at PLAY for USB memory, [TEST12] Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 53 | LED_ACCESS | O | [LED]Lighting output terminal when memory is being accessed, [LRCK]Digital Audio channel clock or SPDIF output terminal |
| 54 | LED_RANDOM | O | [LED]Lighting output terminal at PLAY for RANDOM, [BCK]Digital Audio bit clock output terminal |
| 55 | LED_REPEAT | O | [LED]Lighting output terminal at PLAY for REPEAT, [DATA]Digital Audio data output terminal |
| 56 | TEST13 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 57 | DVDD | — | CORE Power supply(VDD2) terminal |
| 58 | TEST14 | I | Connect to GND(TEST PIN) |
| 59 | TEST15 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 60 | TEST16 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 61 | TEST17 | I | Pull-up to VDD1 system power supply terminal(TEST PIN) |
| 62 | DVSS | — | GND terminal |
| 63 | TMODE | I | Connect to GND(TEST PIN) |
| 64 | DVDDIO | — | IO Power supply(VDD1) terminal |

◇ External dimensions - Block diagram



(UNIT: mm)
Drawing No. EX252-8001

Figure 1. External dimension

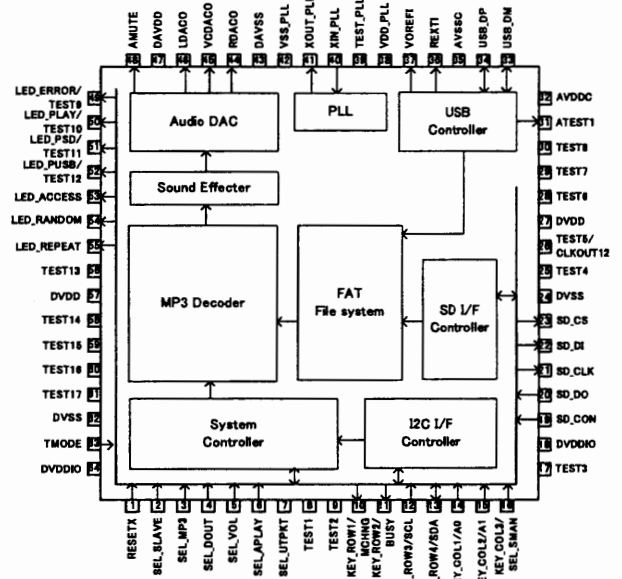


Figure 2. Block diagram

◇ Caution

- (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 and 1.5V system power supply, afterwards, please make the terminal RESETX High level after 5us after the oscillation of the system clock is steady. Moreover, please make the terminal RESETX Low level during 5us 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.