

32-bit, 768 kHz Sampling Stereo Audio D/A Converter

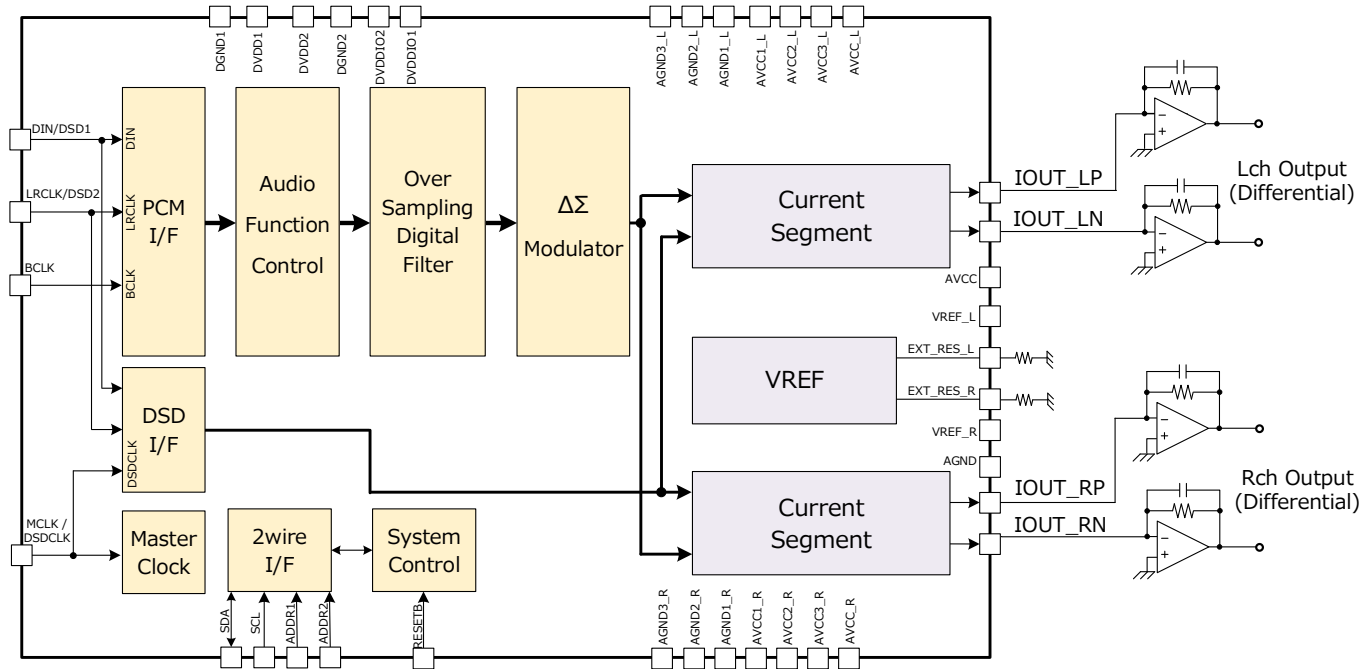
# BD34301EKV Evaluation Board

IC Introduction

BD34301EKV is a 32-bit Stereo Audio D/A Converter with ROHM original sound quality design, realizing excellent performance (SNR: 130 dB (Typ), THD+N: -115 dB (Typ))\*1 suitable for high-end audio. Different type sound is realized by selecting 2 kinds of digital FIR filters (Sharp Roll-Off, Slow Roll-Off). PCM I/F supports up to 768 kHz and DSD I/F supports up to 22.4 MHz.

\*1 BD34301EKV-EVK is tuned for listening evaluation. Electrical performance, External CR values are different from BD34301EKV Datasheet. (SNR: 125 dB (Typ) at Balance Output)

## BD34301EKV Block Diagram



## Recommended Operating Conditions

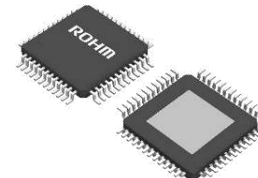
| Item                  | Symbol | Ratings    | Unit |
|-----------------------|--------|------------|------|
| Power Supply Voltage  | AVCC*1 | 4.5 to 5.5 | V    |
|                       | DVDDIO | 3.0 to 3.6 |      |
|                       | DVDD   | 1.4 to 1.6 |      |
| Operating Temperature | Topr   | -25 to +85 | °C   |

\*1 AVCC, AVCC\_R, AVCC\_L in Block Diagram.

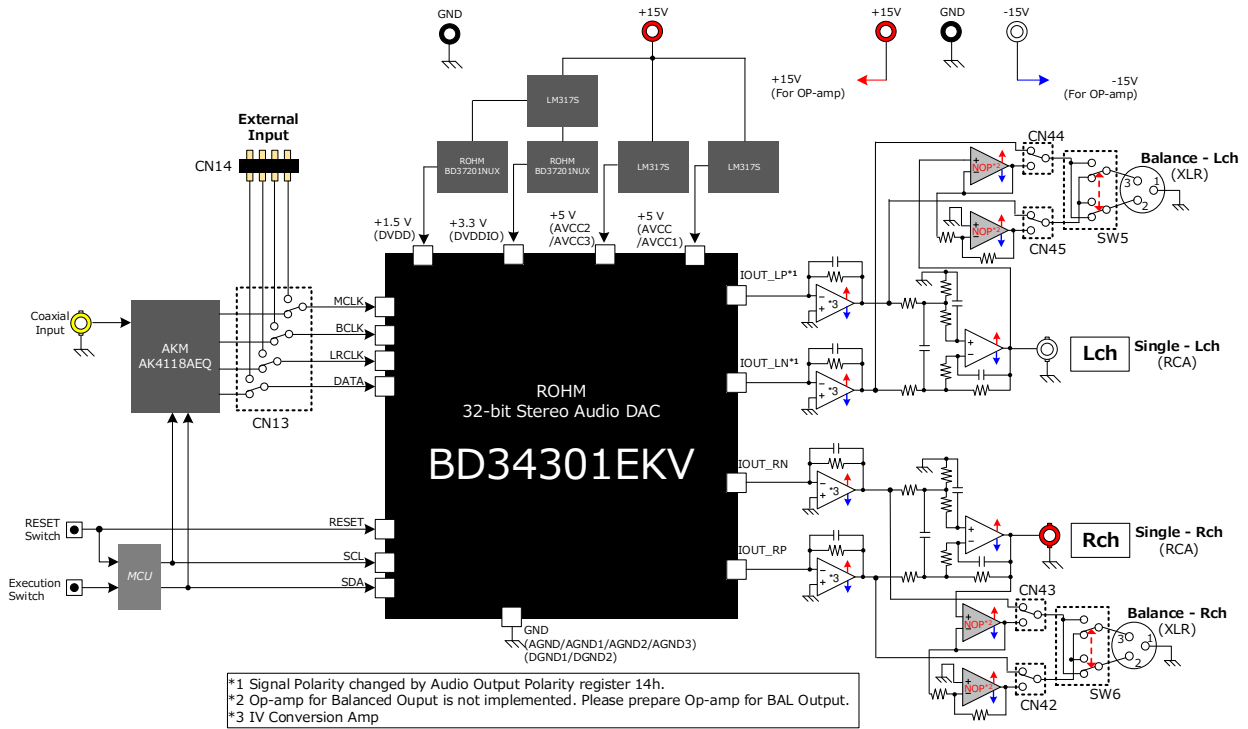
## Package

HTQFP64BV (64 pin, 0.5 mm pitch)

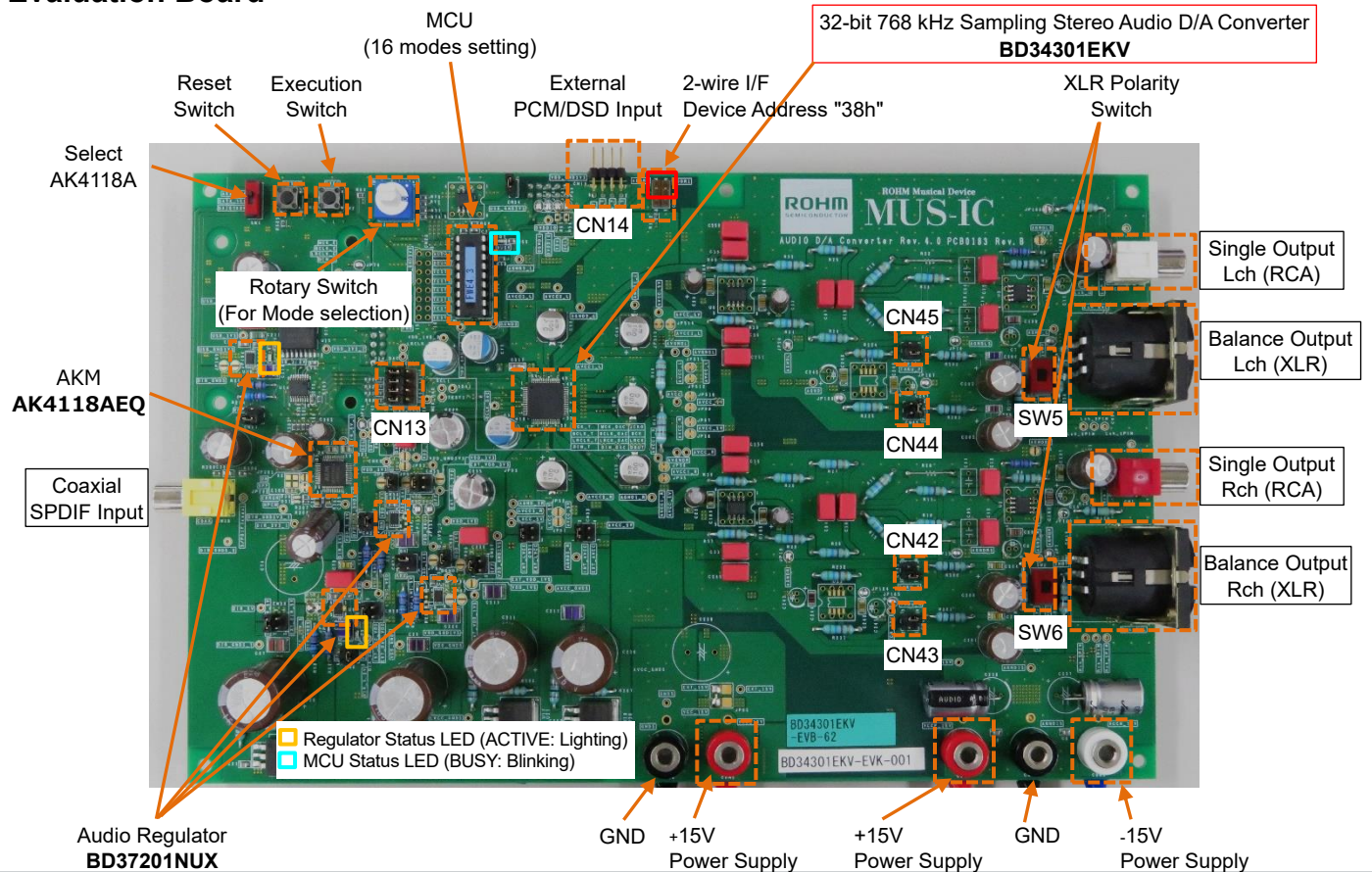
W(Typ) D(Typ) H(Max)  
12.0 mm x 12.0 mm x 1.00 mm



Evaluation Board Block Diagram

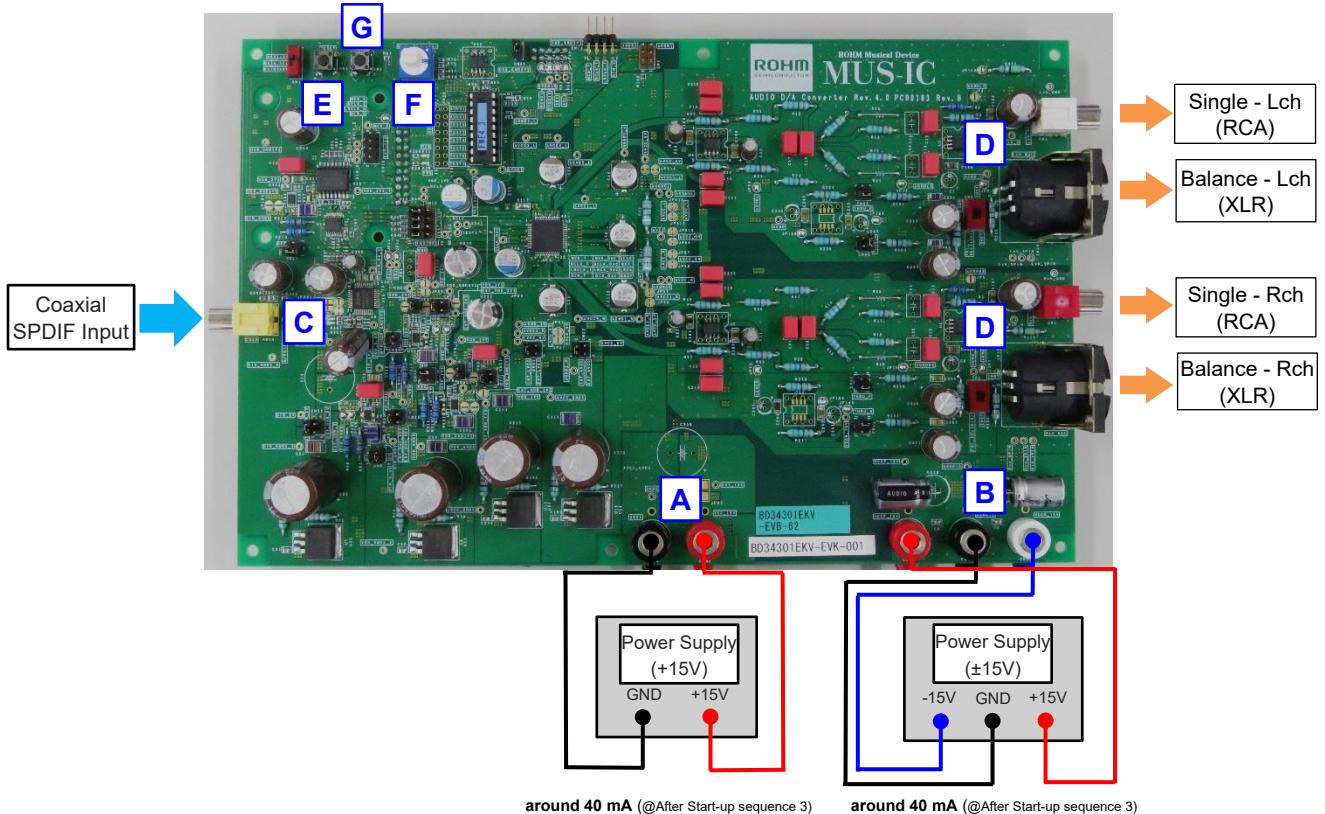


Evaluation Board



## Hardware Setup (Proceed set-up procedure from "A" to "G" in sequence)

- 1) Connect "+15V Power Supply" to "A".
- 2) Connect "±15V Power Supply" to "B".
- 3) Connect "Coaxial SPDIF Input" to "C".
- 4) Connect "Single Output" or "Balance Output" to "D".



## Start-up/Shutdown Procedure

### Start-up Procedure

- 1) Power Amplifier connecting Evaluation Board Output set to "Mute ON".
- 2) Set "+15V Power Supply" turn "ON".
- 3) Set "±15V Power Supply" turn "ON".
- 4) Push Reset switch "E".
- 5) Turn the Rotary Switch "F" to select Mode.
- 6) Push Execution Switch "G".
- 7) MCU status indicator LED will blink during BUSY. Wait for LED to turn off.
- 8) Power Amplifier connecting Evaluation Board Output set to "Mute OFF".
- 9) Start playback.

### Shutdown Procedure

- 1) Stop playback.
- 2) Power Amplifier connecting Evaluation Board Output set to "Mute ON".
- 3) Set "±15V Power supply" turn "OFF".
- 4) Set "+15V Power supply" turn "OFF".

### Mode Selection

There are 16 Modes selectable on BD34301EKV Evaluation Board, as listed in the following table:

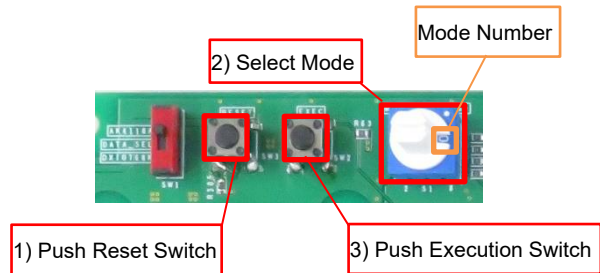
It is possible to select each mode by Rotary Switch.

| Mode No. of Rotary Switch | Format                 | Filter Type   | Input                           | MCLK   | FIR Filter <sup>4</sup> |               | Over Sampling Rate <sup>6</sup> |                         |     |   |      |      | Sampling Frequency fs [kHz] |           |             |             |             |  |  |  |  |   |
|---------------------------|------------------------|---------------|---------------------------------|--|-------------------------|---------------|---------------------------------|-------------------------|-----|---|------|------|-----------------------------|-----------|-------------|-------------|-------------|--|--|--|--|---|
|                           |                        |               |                                 |  | FirAlgo [3:0]           | FirCoef [2:0] | X8                              | X16                     | x32 | x64                                     | x128 | x256 | 44.1 / 48                   | 88.2 / 96 | 176.4 / 192 | 352.8 / 384 | 705.6 / 768 |  |  |  |  |   |
| Mode 0 <sup>1</sup>       | PCM (I <sup>2</sup> S) | Sharp1        | Coaxial SPDIF                   | 512 x fs   | 1h                      | 0h            |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode 1 <sup>1</sup>       |                        |               |                                 | 256 x fs   | 2h                      | 1h            |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode 2 <sup>1</sup>       |                        |               |                                 | 128 x fs   | 4h                      | 2h            |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode 3 <sup>1</sup>       |                        |               | External PCM (I <sup>2</sup> S) | 22.579 MHz (fs=705.6 k)<br>24.576 MHz (fs=768 k)                 | 8h                      | 0h            | O                               |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  | O |
| Mode 4                    |                        | Not Available |                                 |  |                         |               |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode 5 <sup>2</sup>       |                        | Sharp2        | Coaxial SPDIF                   | 512 x fs   | 1h                      | 0h            |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode 6 <sup>2</sup>       |                        |               |                                 | 256 x fs   | 2h                      | 1h            |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode 7 <sup>2</sup>       |                        | 128 x fs      |                                 | 4h   | 2h                      |               |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode 8 <sup>2,3</sup>     |                        | Slow          |                                 | 512 x fs   | 1h                      | 3h            |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode 9 <sup>2</sup>       |                        |               | 256 x fs                        | 2h   | 4h                      |               |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode A <sup>2</sup>       |                        |               | 128 x fs                        | 4h   | 5h                      |               |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode B <sup>2</sup>       |                        | -             | External PCM (I <sup>2</sup> S) | 22.579 MHz (fs=352.8 k, 705.6 k)<br>24.576 MHz (fs=384 k, 768 k) | 8h                      | 0h            |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  | O |
| Mode C <sup>2</sup>       |                        |               |                                 | 8h   | 0h                      |               |                                 |                         |     |   |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode D <sup>2</sup>       |                        | DSD           | -                               | External DSD   | -                       | 0h            | 0h                              | DSD Filter <sup>5</sup> | 02  | Input Signal: DSD64(2.8M), DSD128(5.6M) |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode E <sup>2</sup>       |                        |               |                                 |  |                         | 0h            | 0h                              |                         | 01  | Input Signal: DSD256(11.2M)             |      |      |                             |           |             |             |             |  |  |  |  |   |
| Mode F <sup>2</sup>       |                        |               |                                 |  |                         | 0h            | 0h                              |                         | 00  | Input Signal: DSD512(22.4M)             |      |      |                             |           |             |             |             |  |  |  |  |   |

\*1 Mode 0 to 3 are Electrical Characteristics in BD34301EKV Datasheet.  
 \*2 Mode 5 to F are Recommended Settings in BD34301EKV Datasheet.  
 \*3 Although Recommended setting is HpcMode = 1, only Mode 8 uses HpcMode = 0.  
 \*4 Refer to BD34301EKV Datasheet P28 [18. Address 30h, 31h (FIR Filter 1, FIR Filter 2)]  
 \*5 Refer to BD34301EKV Datasheet P23 [11. Address 16h (DSD Filter)]  
 \*6 Over Sampling Rate of FIR filter is included.

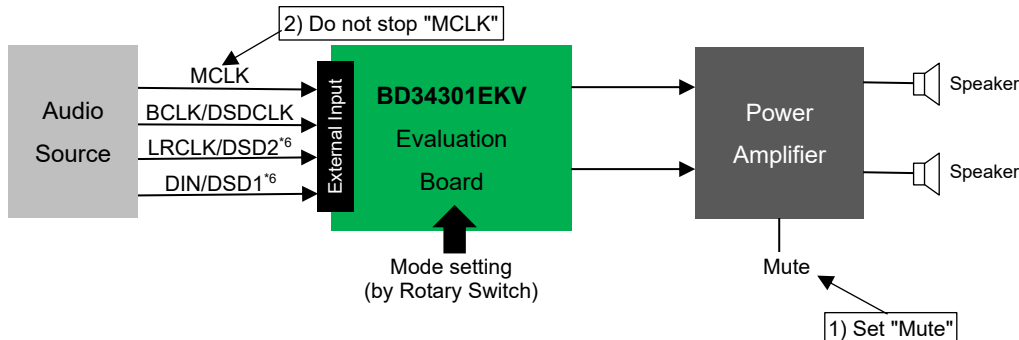
### Mode Setting

- 1) Push Reset Switch.
- 2) Turn the Rotary Switch to select Mode.
- 3) Push Execution Switch.



### Mode Change

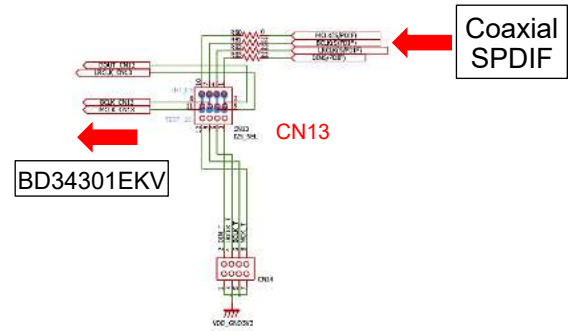
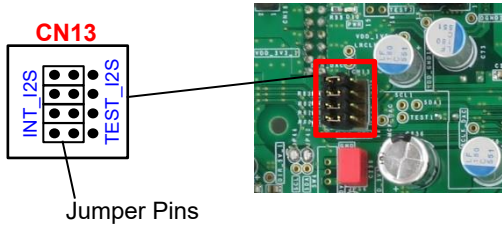
- 1) Set to Mute the Power Amplifier connecting Evaluation Board Output to avoid pop-noise when changing Mode in the Rotary Switch.
- 2) Do not stop input to "MCLK" when changing Mode, while selecting the "External PCM or DSD" input.



## Input Terminal

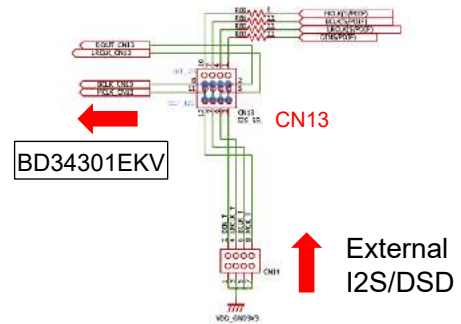
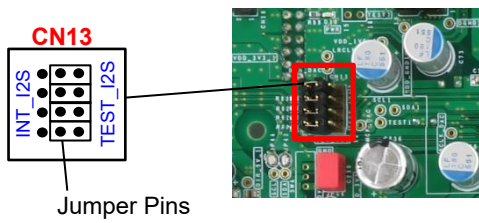
### Coaxial SPDIF Input

Connect between BD34301EKV(Center) and "INT\_I2S"(Left side) by using 4 Jumper Pins.

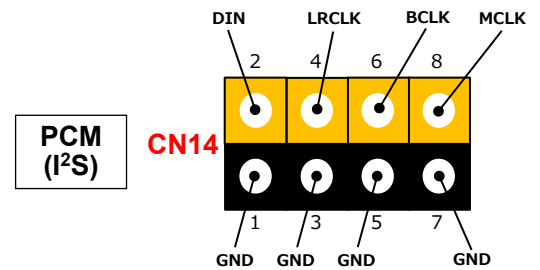
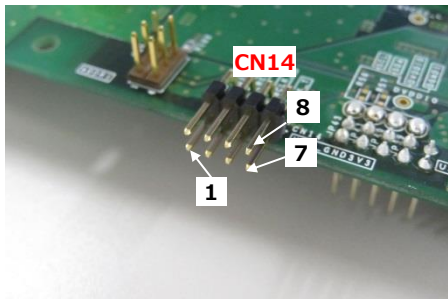


### External PCM(I<sup>2</sup>S) /DSD Input

Connect between BD34301EKV(Center) and "TEST\_I2S"(Right side) by using 4 Jumper Pins.

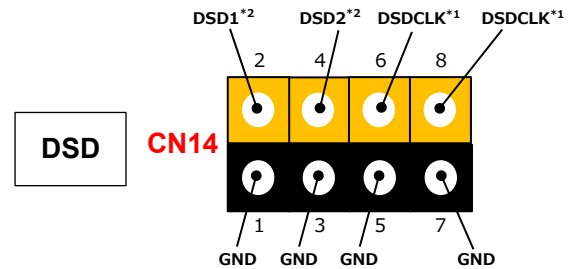


When using External Input, Pin assignments are as follows.



\*1 "DSDCLK" should be input to both the 6pin and 8pin of CN14.

\*2 DSD1 and DSD2 are swapped because Register 13h sets to 1h on this board.



### Output Terminal

#### UNBAL(RCA) - (default)

The sound quality is tuned using this pin for this EVK.

#### BAL(THRU-XLR)<sup>\*1</sup> - (Direct Output from IV Conversion Amp<sup>\*2</sup>)

Connect Jumper Pins to "THRU\_P" side at CN42, CN44.

Connect Jumper Pins to "THRU\_N" side at CN43, CN45.

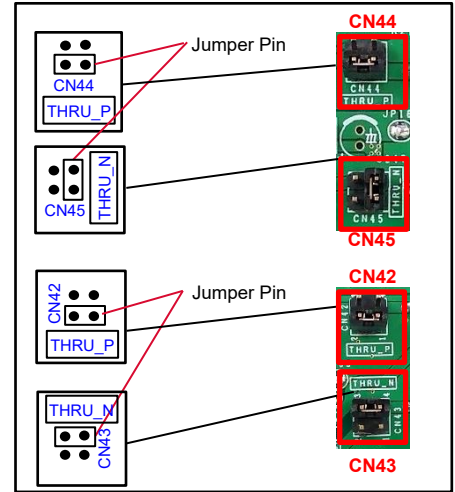
The Polarity of XLR (Hot/Cold) can be switched by SW5, SW6.

<sup>\*1</sup> This terminal is direct output from IV Conversion Amp.

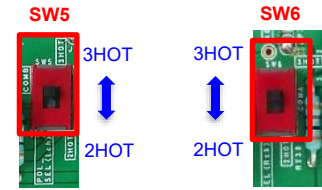
<sup>\*2</sup> Refer to Page 2, Evaluation Board Block Diagram.

| XLR Output Polarity | Switch Position       |          |
|---------------------|-----------------------|----------|
|                     | SW5(Lch)              | SW6(Rch) |
| 2-HOT, 3-COLD       | "3-HOT" <sup>*3</sup> | "2-HOT"  |
| 2-COLD, 3-HOT       | "2-HOT"               | "3-HOT"  |

<sup>\*3</sup> Polarity inverted by register 14h.



Jumper Pin Setting for BAL(THRU-XLR)



Polarity Switch for XLR Output

#### BAL(Op-amp-XLR) - (Additional Op-amp needed)<sup>\*4</sup>

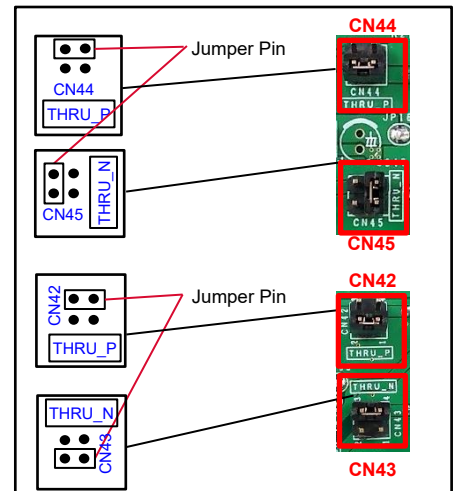
Connect Jumper Pins to "NOT THRU\_P" side at CN42, CN44.

Connect Jumper Pins to "NOT THRU\_N" side at CN43, CN45.

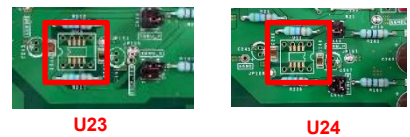
The Polarity of XLR Hot/Cold can be switched by SW5, SW6.

<sup>\*4</sup> Op-amp for XLR Output is not implemented. Implement prepared Op-amp to U23 and U24.  
Operation confirmed: NE5532, OPA2134

| XLR Output Polarity | Switch Position |          |
|---------------------|-----------------|----------|
|                     | SW5(Lch)        | SW6(Rch) |
| 2-HOT, 3-COLD       | "2-HOT"         | "2-HOT"  |
| 2-COLD, 3-HOT       | "3-HOT"         | "3-HOT"  |



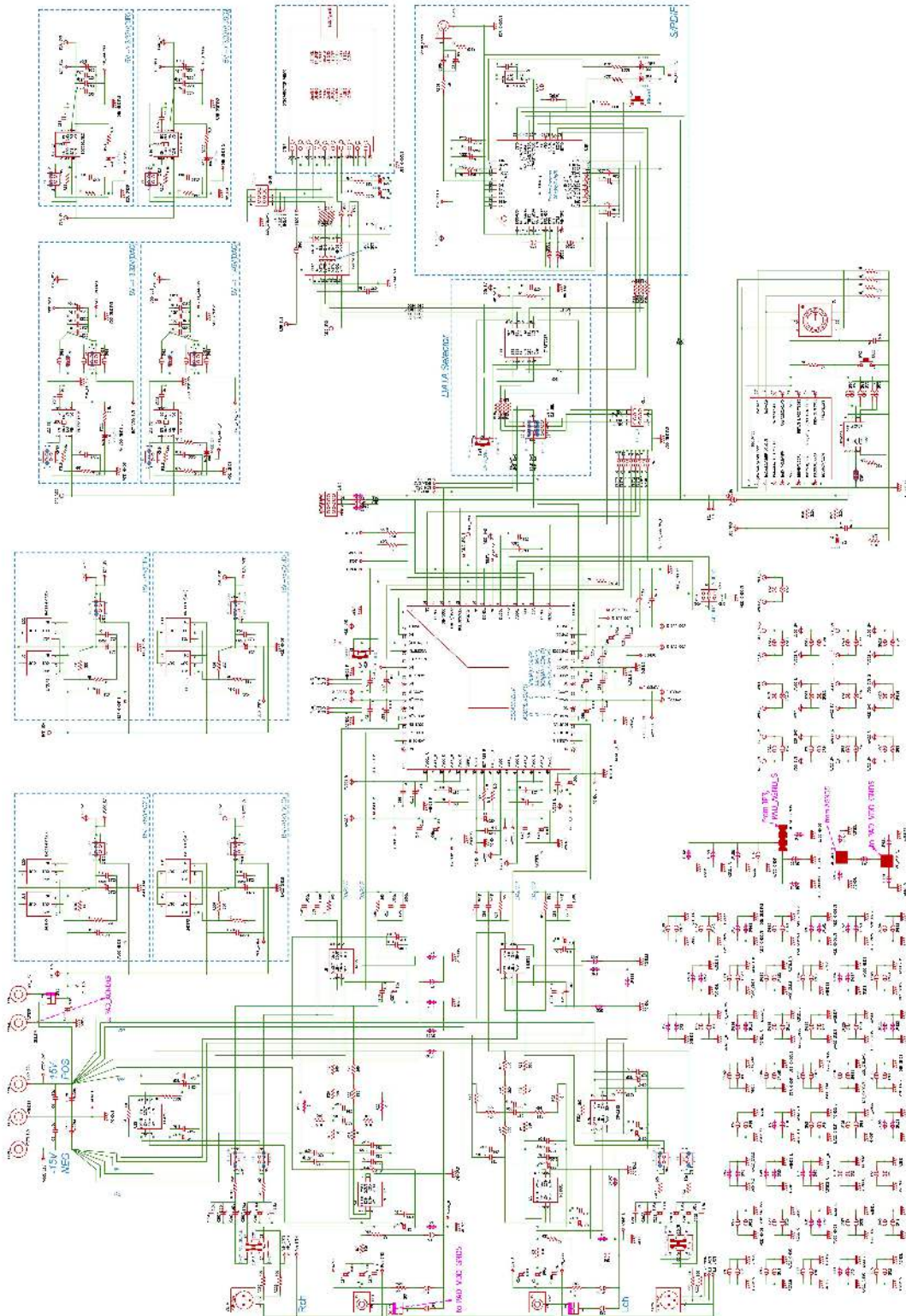
Jumper Pin setting for BAL(Op-amp-XLR)



Op-amp placement for BAL(Op-amp-XLR)

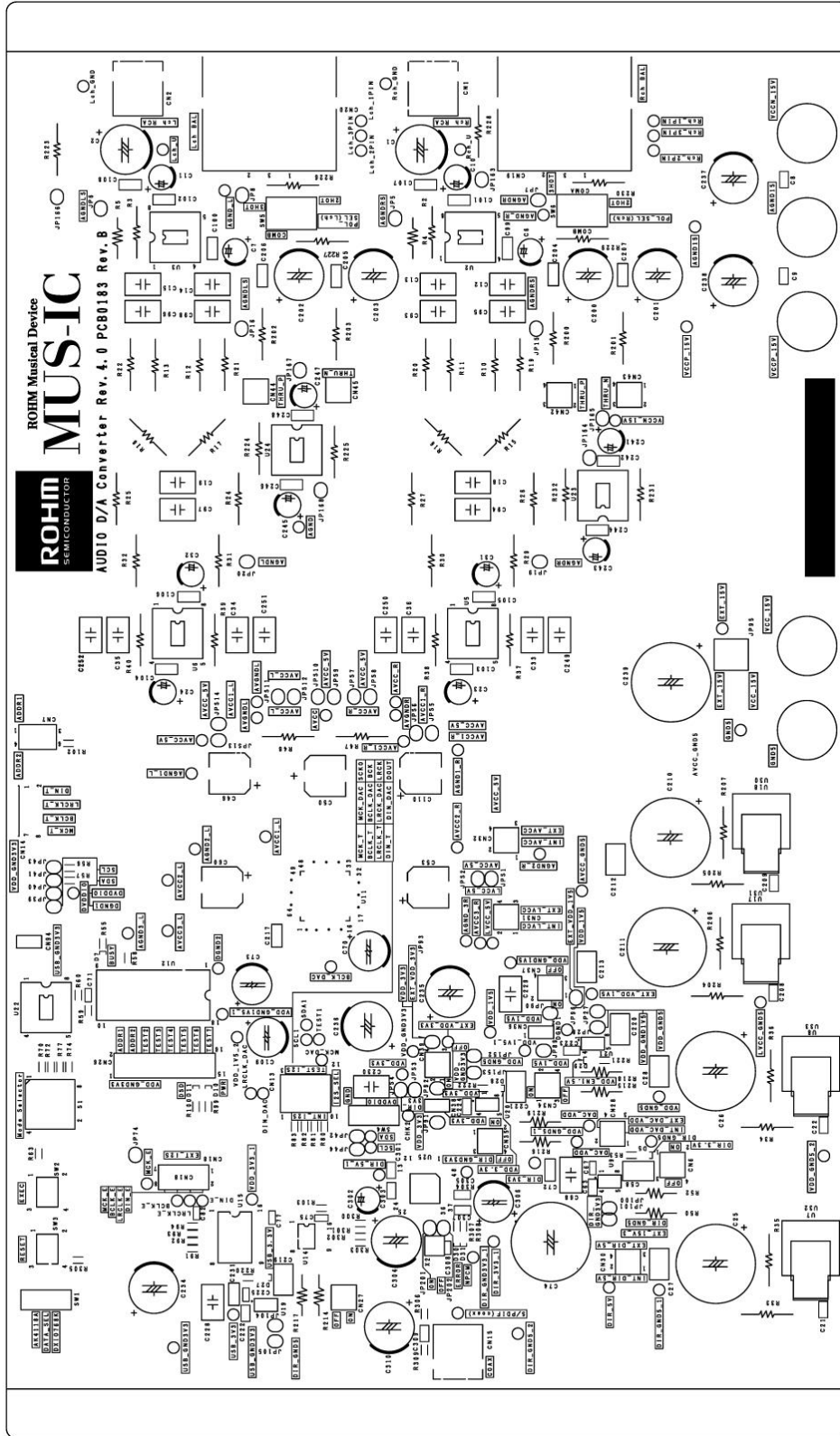
### Evaluation Board Schematic

Click inside Circuit Diagram area to open high resolution Circuit Diagram.



PCB Patterns

Top Silk

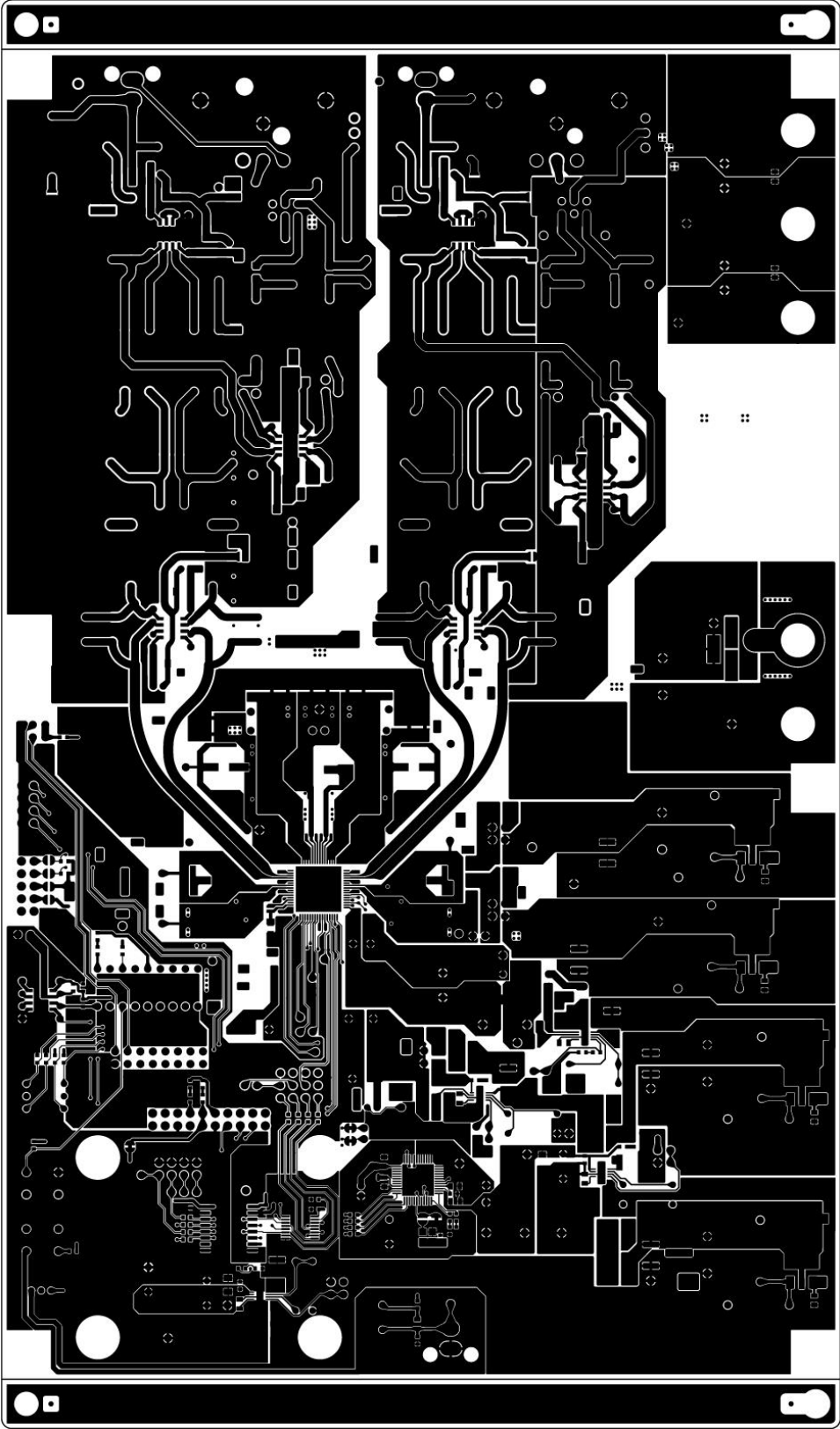




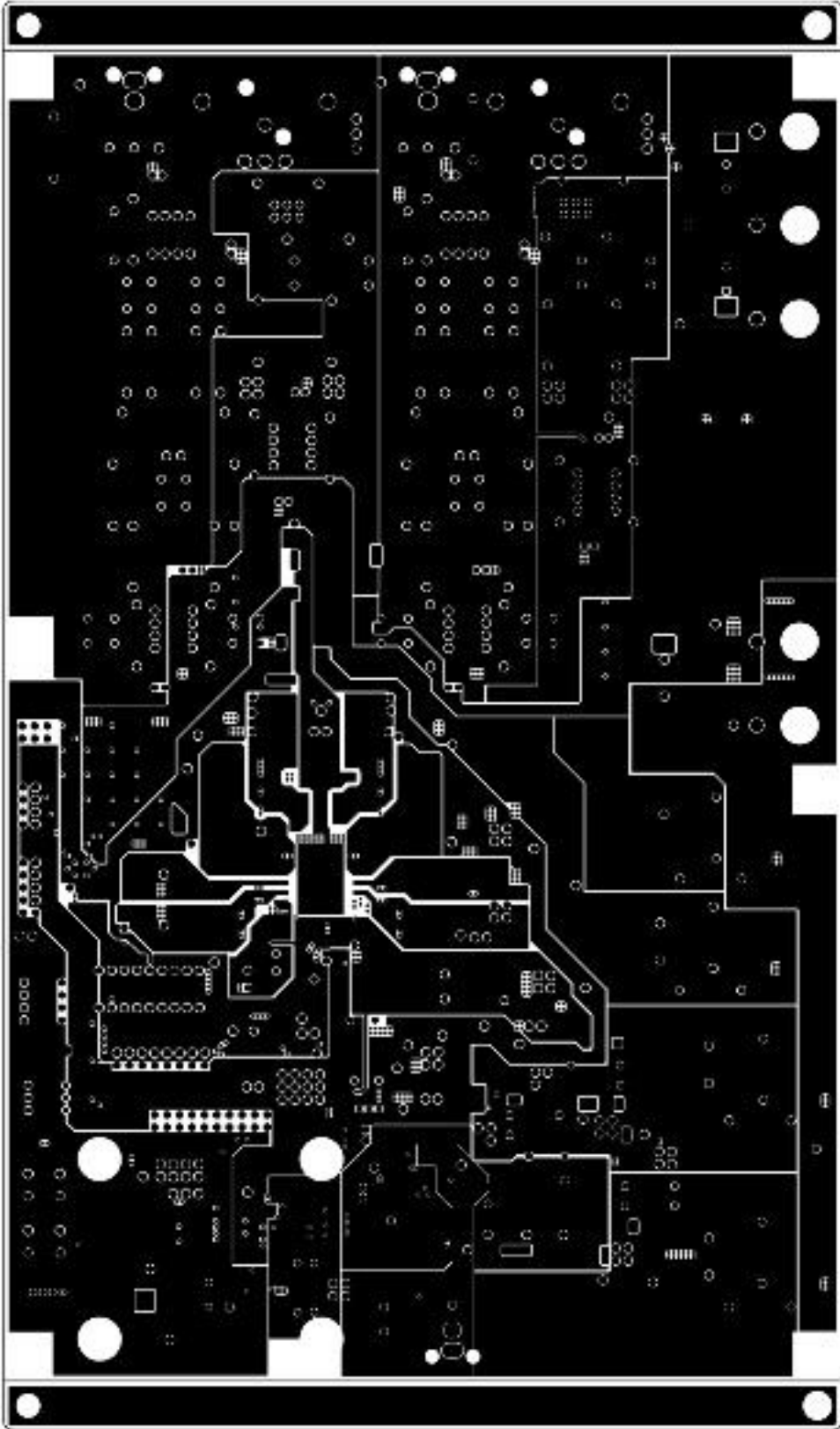
Bottom Silk



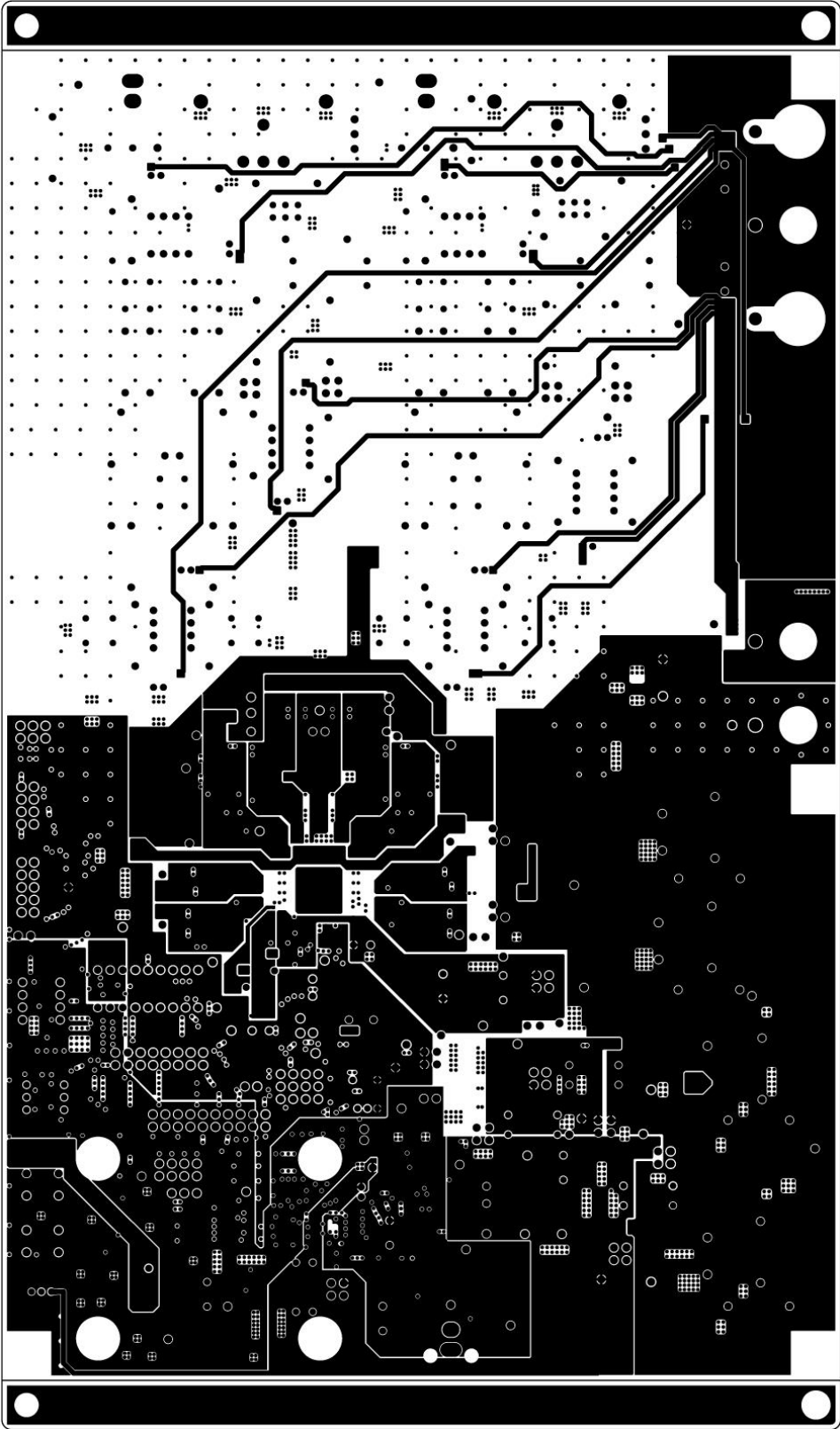
TOP Layer



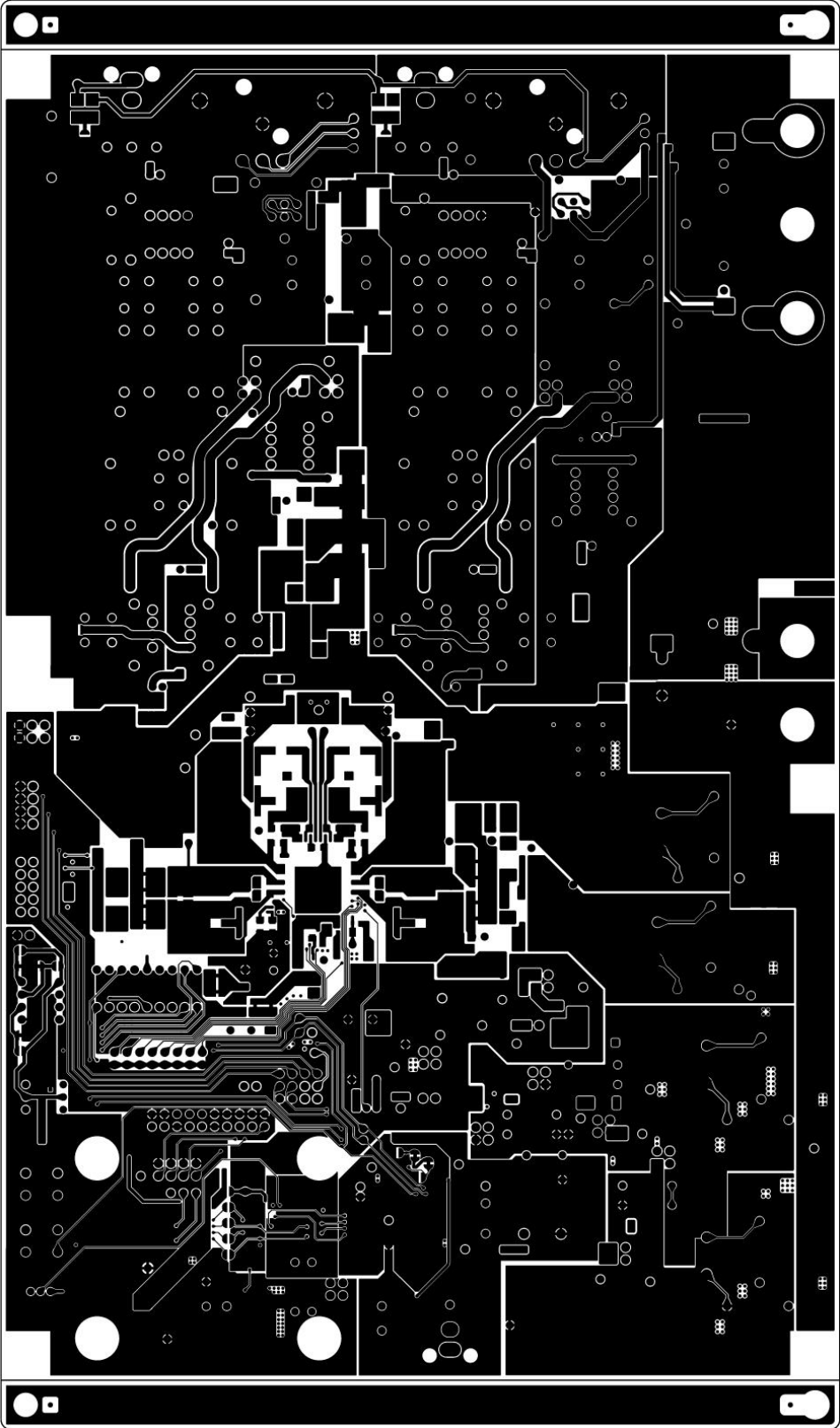
M1 Layer



M2 Layer



Bottom Layer



## Bill of Materials

|           | Quantity       | Type                   | Component No.  | Manufacturer            | Product No.            |
|-----------|----------------|------------------------|--|-------------------------|------------------------|
| Capacitor | 10             | 0.1 $\mu$ F            | C67, C71, C75, C76, C77, C82, C225, C226, C227, C308   | Murata                  | GCM188L81H104KA57D     |
|           | 4              | 0.1 $\mu$ F            | C301, C303, C305, C307   | Rubycon                 | 25MU104KZ22012         |
|           | 19             | 0.1 $\mu$ F            | C21, C22, C40, C41, C42, C44, C45, C47, C49, C51, C52, C54, C55, C208, C209, C215, C216, C217, C691                              | Murata                  | GRM21BB11H104KA01L     |
|           | 22             | 1.5 $\mu$ F            | C72, C99, C100, C101, C102, C103, C104, C105, C106, C107, C108, C204, C205, C206, C207, C231, C232, C233, C242, C244, C246, C248 | Rubycon                 | 16MU155MA23216         |
|           | 6              | 1000 pF                | C18, C19, C249, C250, C251, C252   | WIMA                    | FKP2D011001D00         |
|           | 4              | 1000 $\mu$ F           | C25, C26, C210, C211   | ELNA                    | RFS-16V102MJ7#5        |
|           | 15             | 100 $\mu$ F            | C1A, C1B, C2A, C2B, C200A, C200B, C201A, C201B, C202A, C202B, C203A, C203B, C234, C304, C310                                     | ELNA                    | RFS-16V101MH3#5        |
|           | 2              | 470 $\mu$ F            | C235, C236   | Toshin Kogyo            | 1CUTSJ471M0            |
|           | 2              | 220 $\mu$ F            | C237, C238   | Toshin Kogyo            | 1HUTSJ221M0            |
|           | 11             | 100 $\mu$ F            | C37, C38, C43, C46, C48, C50, C53, C57, C59, C60, C110   | Nippon Chemi-con        | EMAR160ADA101MH63G     |
|           | 5              | 10 $\mu$ F             | C23, C24, C31, C32, C302   | ELNA                    | RFS-35V100ME3#5        |
|           | 2              | 10 $\mu$ F             | C8, C9   | Murata                  | GRM21BR61E106KA73      |
|           | 9              | 10 $\mu$ F             | C27, C28, C58, C212, C213, C219, C220, C221, C306A   | Rubycon                 | 16MU106MC44532         |
|           | 8              | 1500 pF                | C12, C13, C14, C15, C33, C34, C35, C36   | WIMA                    | FKP2D011501D00         |
|           | 4              | 150 pF                 | C68, C228, C229, C230  | WIMA                    | FKP2D001501D00         |
|           | 5              | 180 $\mu$ F            | C39, C69, C70, C73, C109   | Nichicon                | PLF1C181MDO1           |
|           | 5              | 1 $\mu$ F              | C63, C222, C223, C224, C309  | Murata                  | GRM21BB31E105KA98L     |
| 1         | 220 $\mu$ F    | C306                   | ELNA   | RFS-16V221MH5#5         |                        |
| 2         | 330 pF         | C94, C97               | WIMA   | FKP2D003301D00          |                        |
| Connector | 1              | COAX JACK              | CN1  | SMK                     | LPR6520-0802           |
|           | 1              | COAX JACK              | CN2  | SMK                     | LPR6520-0803           |
|           | 1              | COAX JACK              | CN15   | SMK                     | LPR6520-0804           |
|           | 2              | XLR-M                  | CN19, CN20   | Switchcraft             | PQG3MRA112             |
|           | 2              | Terminal(Black)        | CON2, CON4   | Sato Parts              | TJ-563-B               |
|           | 2              | Terminal(Red)          | CON1, CON5   | Sato Parts              | TJ-563-R               |
| LED       | 1              | Terminal(White)        | CON3   | Sato Parts              | TJ-563-W               |
|           | 5              | Red                    | D5, D7, D10, D27, D30  | ROHM                    | SML-E12V8WT86P         |
|           | 2              | Yellow                 | D11, D31   | ROHM                    | SML-E12Y8WT86          |
| Resistor  | 3              | 0 $\Omega$             | R80, R92, R300   | KOA                     | RK73Z1JTDD             |
|           | 1              | 10 $\Omega$            | R306   | KOA                     | RK73Z1JTD100J          |
|           | 9              | 22 $\Omega$            | R81, R82, R83, R91, R93, R94, R301, R302, R303   | KOA                     | RK73B1JTDD220J         |
|           | 1              | 75 $\Omega$            | R309   | KOA                     | RK73B1JTDD750J         |
|           | 6              | 100 $\Omega$           | R2, R3, R200, R201, R202, R203   | Am transformer          | AMRT 1/2W 100 $\Omega$ |
|           | 24             | 560 $\Omega$           | R10, R11, R12, R13, R15, R16, R17, R18, R24, R25, R26, R27, R29, R30, R31, R32, R37, R38, R39, R40, R224, R225, R231, R232       | Am transformer          | AMRT 1/2W 560 $\Omega$ |
|           | 2              | 910 $\Omega$           | R47, R48   | Am transformer          | AMRT 1/2W 910 $\Omega$ |
|           | 9              | 10 k $\Omega$          | R60, R63, R70, R72, R74, R77, R102, R103, R305   | KOA                     | RK73B1JTDD103J         |
|           | 1              | 10 k $\Omega$ (F)      | R304   | KOA                     | RK73H1JTDD1002F        |
|           | 4              | 1 k $\Omega$           | R33, R34, R204, R205   | Am transformer          | AMRT 1/2W 1k $\Omega$  |
|           | 3              | 130 k $\Omega$         | R52, R217, R219  | Yageo                   | MFR-25FBF52-130K       |
|           | 1              | 150 k $\Omega$         | R215   | Yageo                   | MFR-25FBF52-150K       |
|           | 2              | 2.2 k $\Omega$         | R58, R59   | KOA                     | RK73B1JTDD222J         |
|           | 1              | 2.4 k $\Omega$         | R55  | KOA                     | RK73B1JTDD242J         |
|           | 2              | 22 k $\Omega$          | R4, R5   | Yageo                   | MFR-25FBF52-22K        |
|           | 6              | 3.3 k $\Omega$         | R53, R99, R100, R220, R307, R308   | KOA                     | RK73B1JTDD332J         |
|           | 4              | 330 $\Omega$           | R35, R36, R206, R207   | Am transformer          | AMRT 1/2W 330 $\Omega$ |
|           | 3              | 56 k $\Omega$          | R50, R214, R216  | Yageo                   | MFR-25FRF52-56K        |
|           | 1              | 68 k $\Omega$          | R218   | Yageo                   | MFR-25FRF52-68K        |
| 2         | 100 k $\Omega$ | R223, R228             | Am transformer   | AMRT 1/2W 100k $\Omega$ |                        |
| 4         | 300 $\Omega$   | R226, R227, R229, R230 | Am transformer   | AMRT 1/2W 300 $\Omega$  |                        |

|        | Quantity          | Type             | Component No.            | Manufacturer          | Product No. |
|--------|-------------------|------------------|--------------------------|-----------------------|-------------|
| Switch | 1                 | Rotary Switch    | S1                       | Excel Cell Electronic | ERD216RSZ   |
|        | 1                 | SPDT Switch      | SW1                      | NKK Switches          | SS-12SBP2   |
|        | 2                 | Tactile Switch   | SW2,SW3                  | Alps Alpine           | SKHHAJA010  |
|        | 2                 | DPDT Switch      | SW5,SW6                  | NKK Switches          | SS-22SDP2   |
| IC     | 1                 | Selector         | U14                      | ON Semiconductor      | 74FST3257   |
|        | 1                 | DAC              | U11                      | ROHM                  | BD34301EKV  |
|        | 4                 | Audio Regulator  | U9,U19,U20,U21           | ROHM                  | BD37201NUX  |
|        | 4                 | LDO              | U7,U8,U17,U18            | Texas Instruments     | LM317S      |
|        | 1                 | EEPROM           | U22                      | ROHM                  | BR24G1M-3A  |
|        | 1                 | Digital Isolator | U15                      | Texas Instruments     | ISO7640FM   |
|        | 4                 | Op-amp           | U2,U3,U5,U6              | Texas Instruments     | NE5532ADR   |
|        | 1                 | MCU              | U12                      | Microchip             | PIC16F88    |
| 1      | Digital Audio I/F | U25              | Asahi Kasei Microdevices | AK4118AEQ             |             |

## Notes

- 1) The information contained herein is subject to change without notice.
- 2) Before you use our Products, please contact our sales representative and verify the latest specifications :
- 3) Although ROHM is continuously working to improve product reliability and quality, semiconductors can break down and malfunction due to various factors.  
Therefore, in order to prevent personal injury or fire arising from failure, please take safety measures such as complying with the derating characteristics, implementing redundant and fire prevention designs, and utilizing backups and fail-safe procedures. ROHM shall have no responsibility for any damages arising out of the use of our Products beyond the rating specified by ROHM.
- 4) Examples of application circuits, circuit constants and any other information contained herein are provided only to illustrate the standard usage and operations of the Products. The peripheral conditions must be taken into account when designing circuits for mass production.
- 5) The technical information specified herein is intended only to show the typical functions of and examples of application circuits for the Products. ROHM does not grant you, explicitly or implicitly, any license to use or exercise intellectual property or other rights held by ROHM or any other parties. ROHM shall have no responsibility whatsoever for any dispute arising out of the use of such technical information.
- 6) The Products specified in this document are not designed to be radiation tolerant.
- 7) For use of our Products in applications requiring a high degree of reliability (as exemplified below), please contact and consult with a ROHM representative : transportation equipment (i.e. cars, ships, trains), primary communication equipment, traffic lights, fire/crime prevention, safety equipment, medical systems, servers, solar cells, and power transmission systems.
- 8) Do not use our Products in applications requiring extremely high reliability, such as aerospace equipment, nuclear power control systems, and submarine repeaters.
- 9) ROHM shall have no responsibility for any damages or injury arising from non-compliance with the recommended usage conditions and specifications contained herein.
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- 11) Please use the Products in accordance with any applicable environmental laws and regulations, such as the RoHS Directive. For more details, including RoHS compatibility, please contact a ROHM sales office. ROHM shall have no responsibility for any damages or losses resulting non-compliance with any applicable laws or regulations.
- 12) When providing our Products and technologies contained in this document to other countries, you must abide by the procedures and provisions stipulated in all applicable export laws and regulations, including without limitation the US Export Administration Regulations and the Foreign Exchange and Foreign Trade Act.
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