



# AKD4367

## Evaluation board Rev.B for AK4367

**GENERAL DESCRIPTION**

AKD4367 is an evaluation board for 24bit DAC with built-in Headphone Amplifier, AK4367. The AKD4367 has the interface with AKM's ADC evaluation boards. Therefore, it's easy to evaluate the AK4367. The AKD4367 also has the digital audio interface and can achieve the interface with digital audio systems via opt-connector.

■ **Ordering guide**

AKD4367 --- Evaluation board for AK4367  
 (Cable for connecting with printer port of IBM-AT compatible PC and control software are packed with this. This control software does not operate on Windows NT.)

**FUNCTION**

- **Compatible with 2 types of interface**
  - Direct interface with AKM's A/D converter evaluation boards
  - On-board AK4116 as DIR which accepts optical input
- **10pin header for serial control interface**

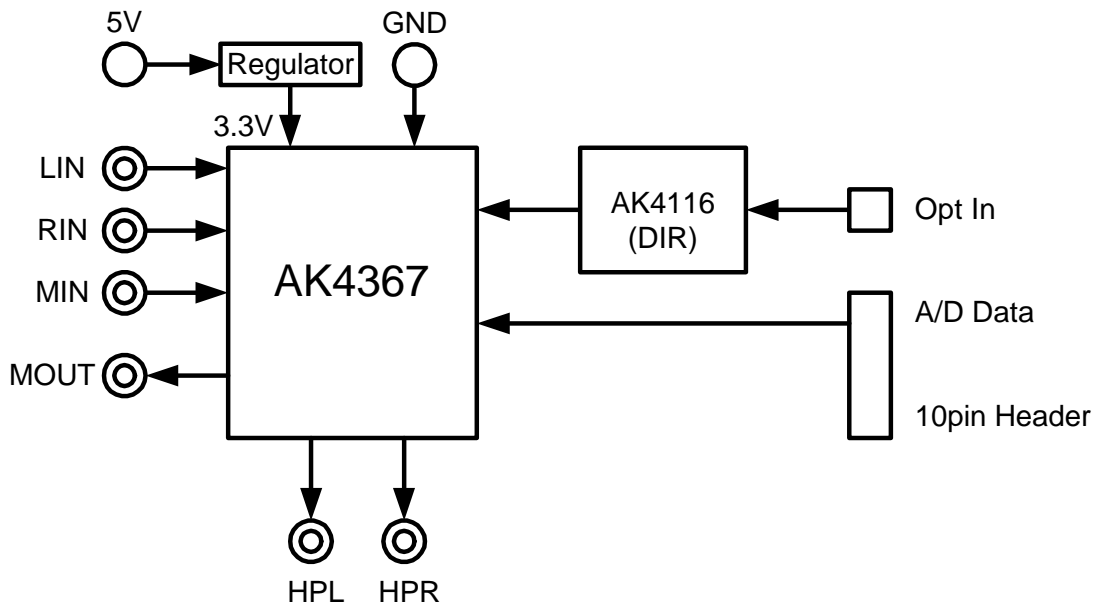


Figure 1. AKD4367 Block Diagram

\* Circuit diagram and PCB layout are attached at the end of this manual.

## 1. Evaluation Board Manual

### ■ Operation sequence

- 1) Set up the power supply lines.
 

[+5V]	(red)	= 5V
[AGND]	(black)	= 0V : for analog ground
[DGND]	(black)	= 0V : for logic ground

Each supply line should be distributed from the power supply unit.

- 2) Set up the evaluation mode, jumper pins. (See the followings.)

- 3) Power on.

The AK4367 and AK4116 should be resets once bringing SW1 (DAC\_PDN) and SW2 (DIR\_PDN) “L” upon power-up.

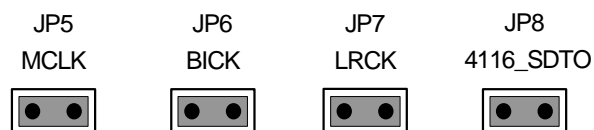
### ■ Evaluation mode

#### Applicable Evaluation Mode

- (1) In case of using DIR (Optical Link) <default>
- (2) In case of connecting AK4367 with a external DSP

- (1) In case of using DIR (Optical Link) <default>

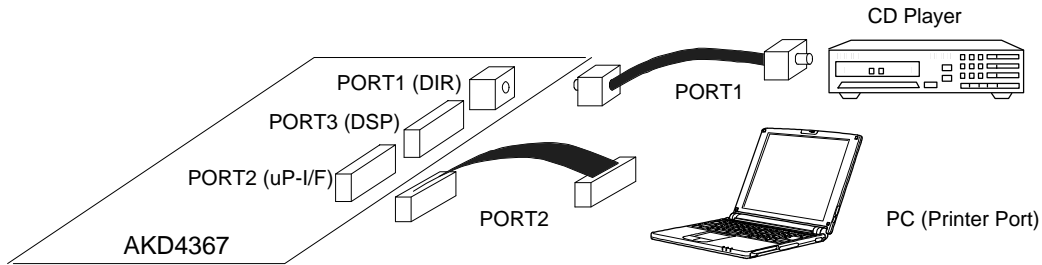
PORT1 (DIR) is used. DIR generates MCLK, BICK, LRCK and SDATA from the received data through optical connector (TORX141). Nothing should be connected to PORT3 (DSP).



■ How to evaluate AK4367 by connecting CD player

AKD4367 can evaluate tone quality easily by connecting CD Player (fs=44.1kHz).

1). Connection Diagram



2). Jumper and Switch Setting

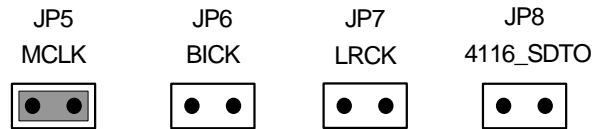
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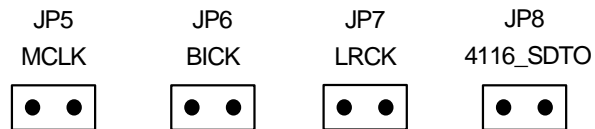
(2) In case of connecting AK4367 with a external DSP

AKD4367 can be connected with an external DSP through PORT3 (DSP).

(1) When BICK, LRCK and SDATA are supplied from DSP, and MCLK is supplied from AK4116.



(2) When MCLK, BICK, LRCK and SDATA are all supplied from DSP.



### ■ The function of the toggle SW

Upper-side is “H” and lower-side is “L”.

[SW1] (DAC\_PDN) : Resets the AK4367. Keep “H” during normal operation.

[SW2] (DIR\_PDN) : Resets the AK4116. Keep “H” during normal operation.

### ■ Indication for LED

[LED1] (ERF): Monitor INT0 pin of the AK4116. LED turns on when unlock or parity error occurs.

### ■ Serial Control

The AK4367 can be controlled via the printer port (parallel port) of IBM-AT compatible PC. Connect PORT2 (uP-I/F) with PC by 10 wire flat cable packed with the AKD4367.

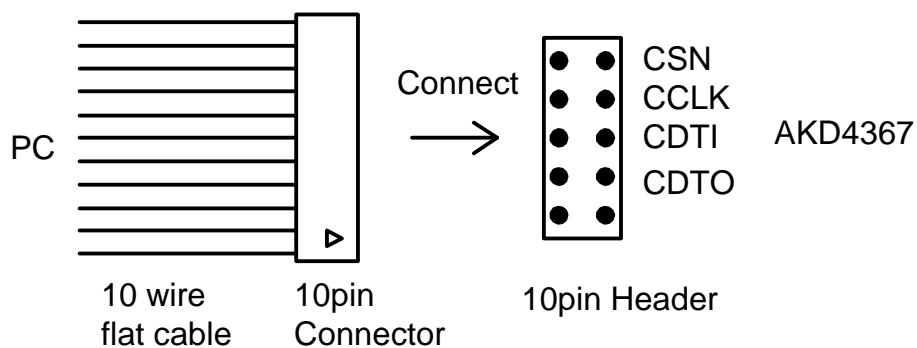


Figure 2. Connection of 10 wire flat cable

■ Input / Output circuit & Set-up jumper pin for Input / Output circuits

(1) Input Circuit

External analog signal is fed through the BNC connector. R21 are resistors to terminate the signal source. This resistors is not assembled on the board.

MIN, LIN, RIN Input circuits

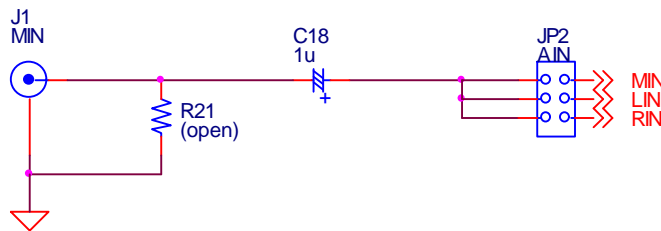


Figure 3. MIN, LIN, RIN Input circuits

- JP2 (AIN) : Input pins are selected for the signals from BNC (J1).
- MIN : Input to MIN pin.
- LIN : Input to LIN pin.
- RIN : Input to RIN pin.

(2) Output Circuit

(a) MOUT Output circuit



Figure 4. MOUT Output circuits

(b) HPL, HPR Output circuit

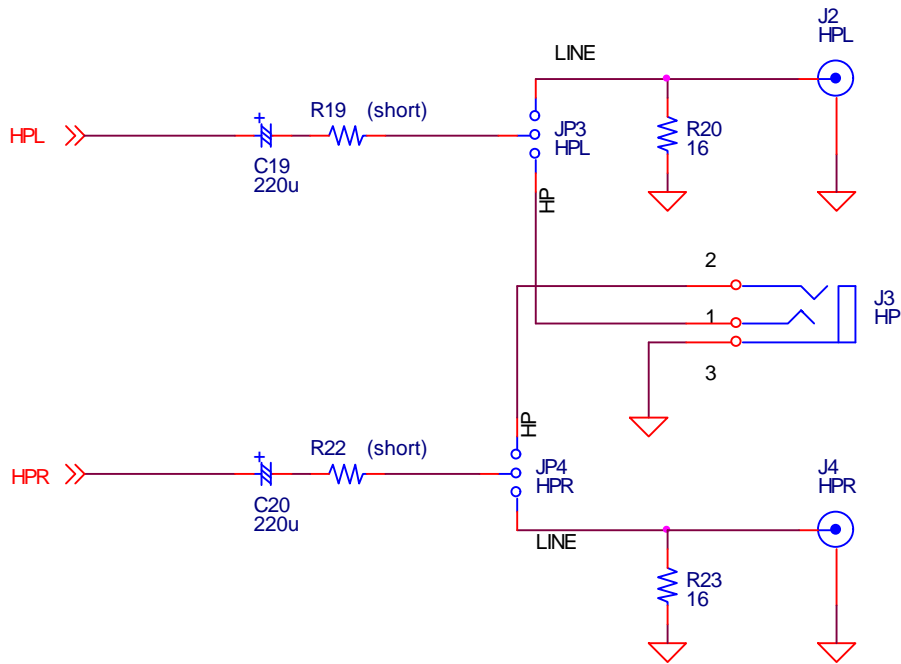
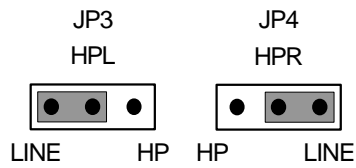
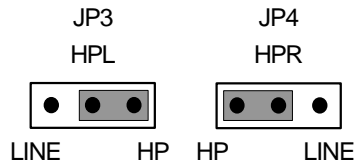


Figure 5. HPL, HPR Output circuit

1. Outputs of HPL and HPR pins are applied via J2 and J4.



2. Outputs of HPL and HPR pins are applied via J3 (mini jack).



(3) Other Jumper Pins

- (a) JP1 (GND) : Analog ground and digital ground
  - open :separated
  - short :common (The connector “DGND” can be open.) <default>

\* AKM assumes no responsibility for the trouble when using the circuit examples.

## 2. Control Software Manual

### ■ Set-up of evaluation board and control software

1. Set up the AKD4367 according to previous term.
2. Connect IBM-AT compatible PC with AKD4367 by 10-line type flat cable (packed with AKD4367). Take care of the direction of 10pin header. (Please install the driver in the CD-ROM when this control software is used on Windows 2000/XP. Please refer "Installation Manual of Control Software Driver by AKM device control software". In case of Windows95/98/ME, this installation is not needed. This control software does not operate on Windows NT.)
3. Insert the CD-ROM labeled "AK4367 Evaluation Kit" into the CD-ROM drive.
4. Access the CD-ROM drive and double-click the icon of "akd4367.exe" to set up the control program.
5. Then please evaluate according to the follows.

### ■ Operation flow

Keep the following flow.

1. Set up the control program according to explanation above.
2. Click "Port Setup" button.
3. Click "Write default" button.

Then set up the dialog and input data.

### ■ Explanation of each buttons

1. [Port Setup] : Set up the printer port.
2. [Write default] : Initialize the register of AK4367.
3. [Function1] : Dialog to write data by keyboard operation.
4. [Function2] : Dialog to evaluate ATT.
5. [Write] : Dialog to write data by mouse operation.

## ■ Explanation of each dialog

1. [Function1 Dialog] : Dialog to write data by keyboard operation

Address Box: Input register address in 2 figures of hexadecimal.  
Data Box: Input register data in 2 figures of hexadecimal.

If you want to write the input data to AK4367, click "OK" button. If not, click "Cancel" button.

2. [Function2 Dialog] : Dialog to evaluate ATT

This dialog corresponds to only addr=04H, 05H and 08H.

Address Box: Input register address in 2 figures of hexadecimal.  
Start Data Box: Input start data in 2 figures of hexadecimal.  
End Data Box: Input end data in 2 figures of hexadecimal.  
Interval Box: Data is written to AK4367 by this interval.  
Step Box: Data changes by this step.  
Mode Select Box:

If you check this check box, data reaches end data, and returns to start data.

[Example] Start Data = 00, End Data = 09  
Data flow: 00 01 02 03 04 05 06 07 08 09 09 08 07 06 05 04 03 02 01 00

If you do not check this check box, data reaches end data, but does not return to start data.

[Example] Start Data = 00, End Data = 09  
Data flow: 00 01 02 03 04 05 06 07 08 09

If you want to write the input data to AK4367, click "OK" button. If not, click "Cancel" button.

3. [Write Dialog] : Dialog to write data by mouse operation

There are dialogs corresponding to each register.

Click the "Write" button corresponding to each register to set up the dialog. If you check the check box, data becomes "H" or "1". If not, "L" or "0".

If you want to write the input data to AK4367, click "OK" button. If not, click "Cancel" button.

## ■ Indication of data

Input data is indicated on the register map. Red letter indicates "H" or "1" and blue one indicates "L" or "0". Blank is the part that is not defined in the datasheet.

## ■ Attention on the operation

If you set up Function1 or Function2 dialog, input data to all boxes. Attention dialog is indicated if you input data or address that is not specified in the datasheet or you click "OK" button before you input data. In that case set up the dialog and input data once more again. These operations does not need if you click "Cancel" button or check the check box.

<b>MEASUREMENT RESULTS</b>
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## [Measurement condition]

- Measurement unit : Audio Precession System Two Cascade
- MCLK : 12.2896MHz
- BICK : 64fs
- fs : 44.1kHz
- Bit : 24bit
- Power Supply : VDD = HVDD = 3.3V
- Measurement Filter : 10Hz ~ 20kHz
- Temperature : Room

Parameter	Result (Lch / Rch)	Unit
<b>DAC Analog Output Characteristics</b>		
THD+N (-3dBFS Output)	56.8 / 56.1	dB
D-Range (-60dB Output, A-weighted)	93.0 / 93.0	dB
S/N (A-weighted)	94.9 / 93.8	dB

<b>Monaural Output Characteristics</b>		
THD+N (0dBFS Output)	64.5	dB
S/N (A-weighted)	95.4	dB

[Plot of Headphone Amplifier]

AKM

AK4367 HP-Amp THD+N vs. Input Level (fs=44.1kHz, fln=1kHz)

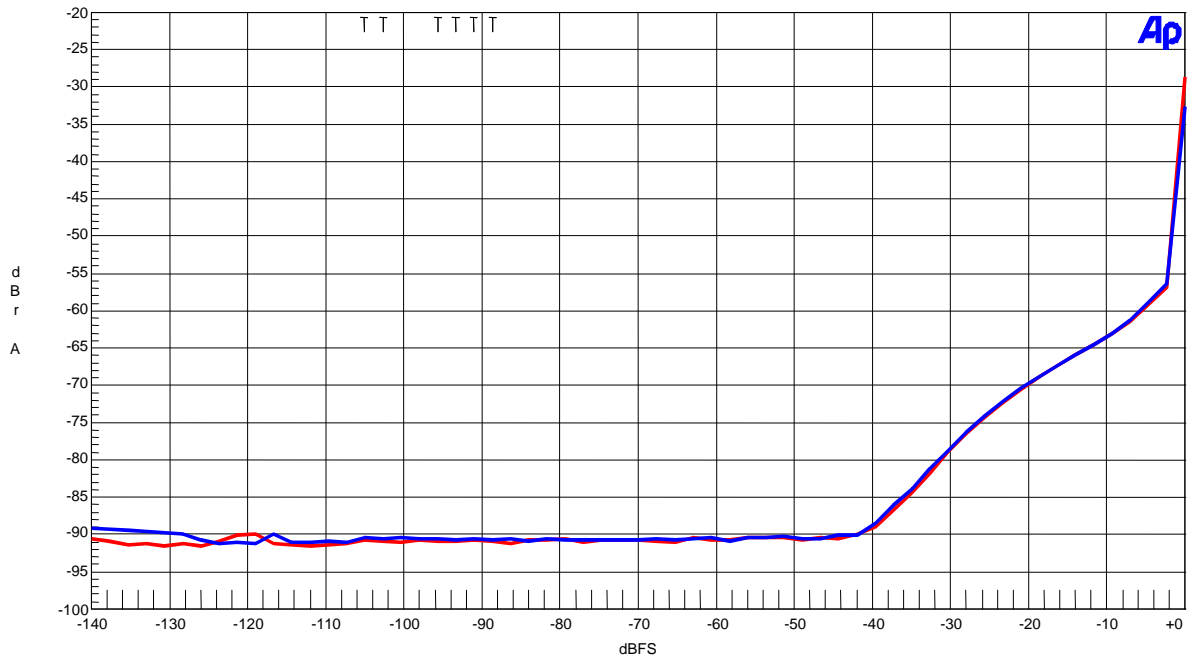


Figure 1. THD+N vs. Input Level

AKM

AK4367 HP-Amp THD+N vs. fin (fs=44.1kHz, Input Level=-3dB)

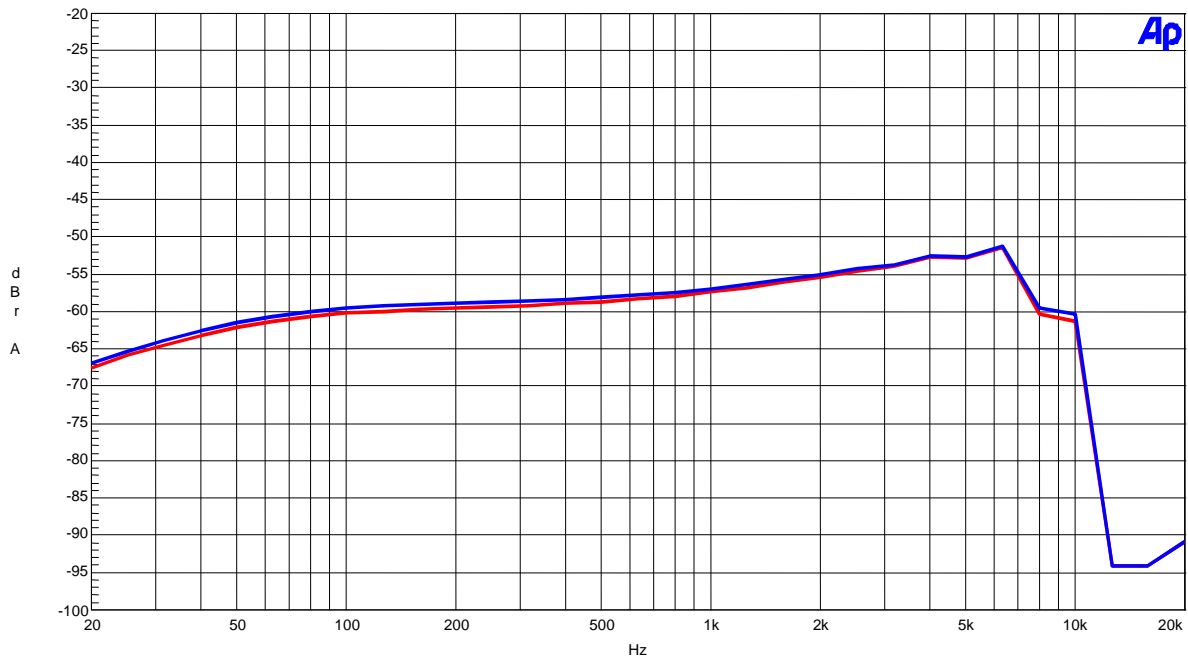


Figure 2. THD+N vs. Input Frequency

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AK4367 HP-Amp Linearity (fs=44.1kHz, fin=1kHz)

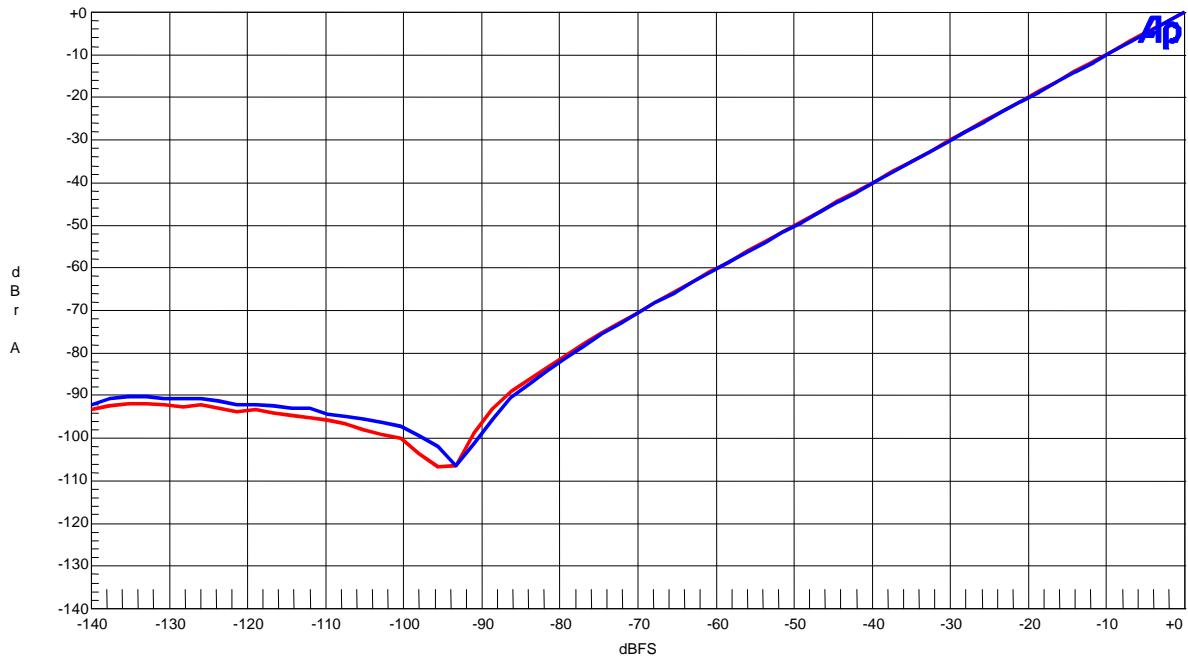


Figure 3. Linearity

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AK4367 HP-Amp Frequency Response (fs=44.1kHz, Input Level=-3dB)

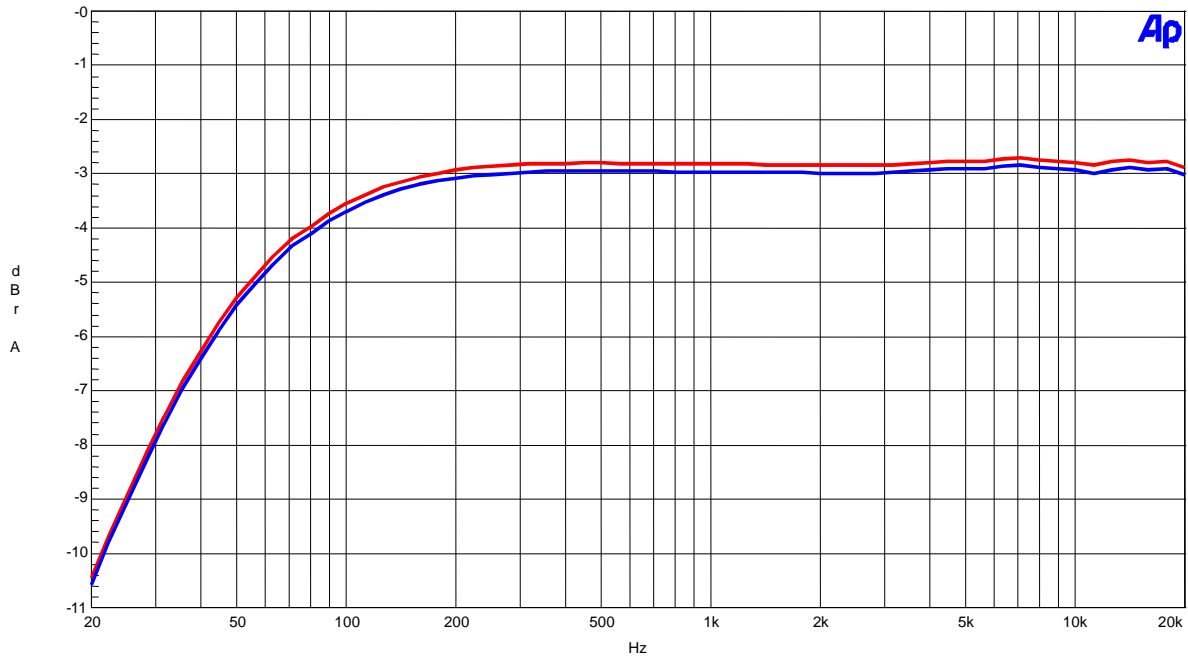


Figure 4. Frequency Response (Boost off)  
(including external HPF)

AKM

AK4367 HP-Amp FFT Out-of-band Noise

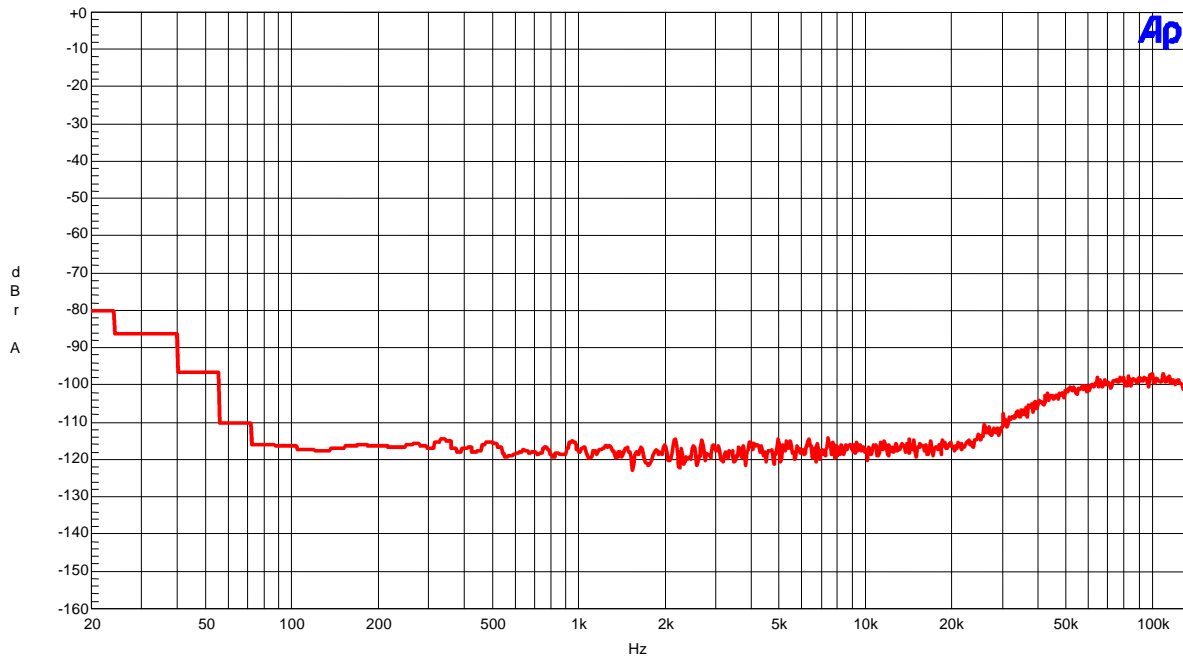


Figure 5. Out-of-band Noise

AKM

AK4367 HP-Amp FFT (fs=44.1kHz, fin=1kHz, Input Level=-3dB)

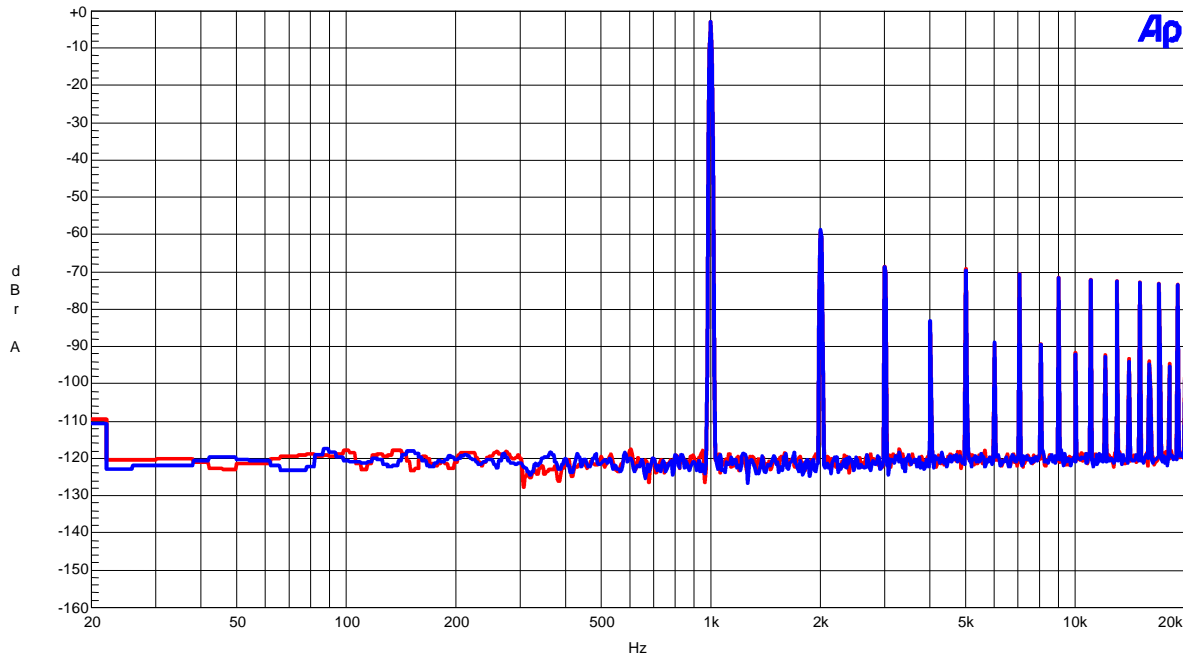


Figure 6. FFT Plot

AKM

AK4367 HP-Amp FFT (fs=44.1kHz, fin=1kHz, Input Level=-60dB)

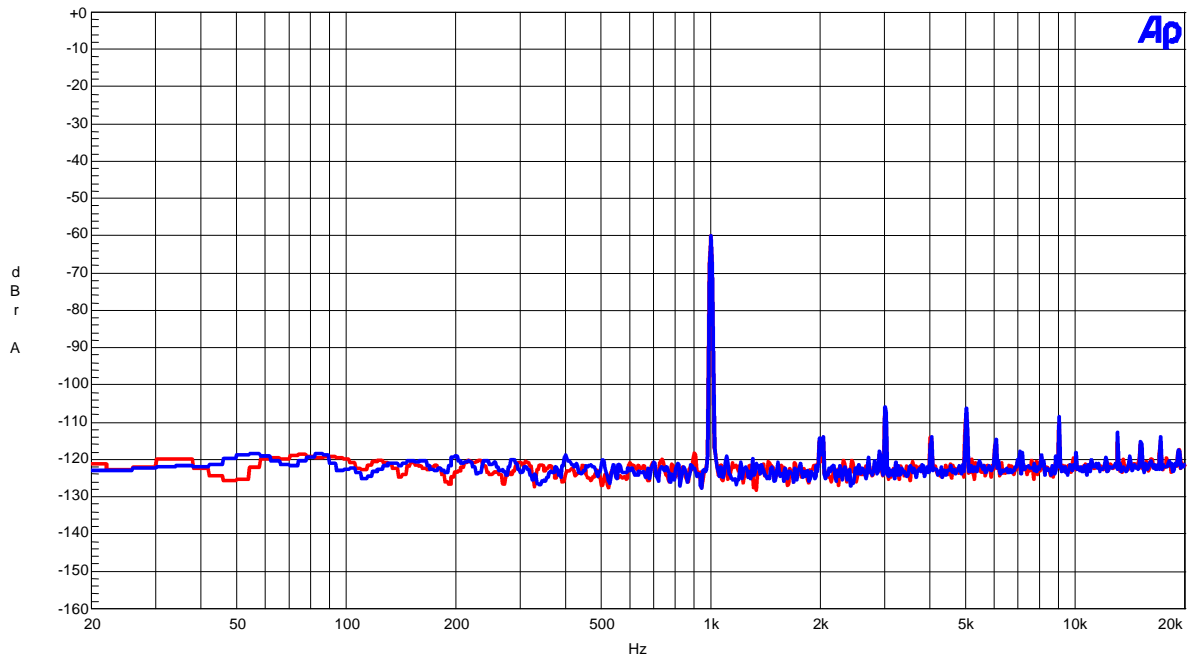


Figure 7. FFT Plot

AKM

AK4367 HP-Amp FFT Noise Floor (No data Input)

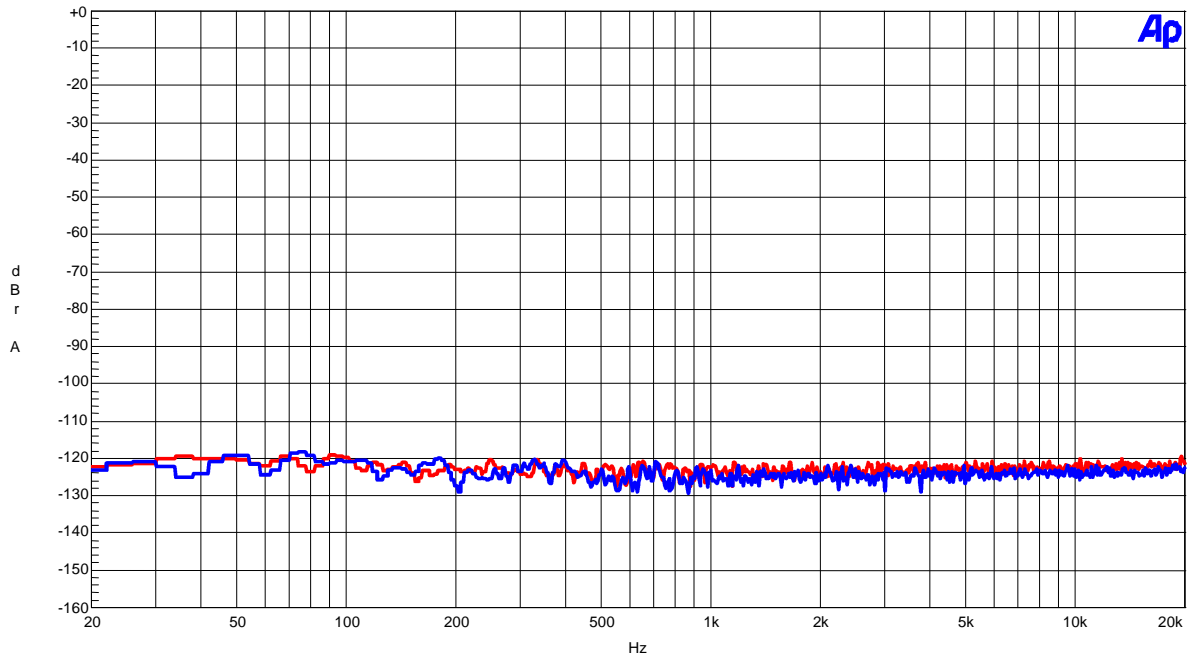


Figure 8. FFT Plot

AKM

AK4367 HP-Amp Crosstalk (fs=44.1kHz, Input Level=-3dB)  
Upper@1kHz:Lch-->Rch, Lower@1kHz:Rch-->Lch

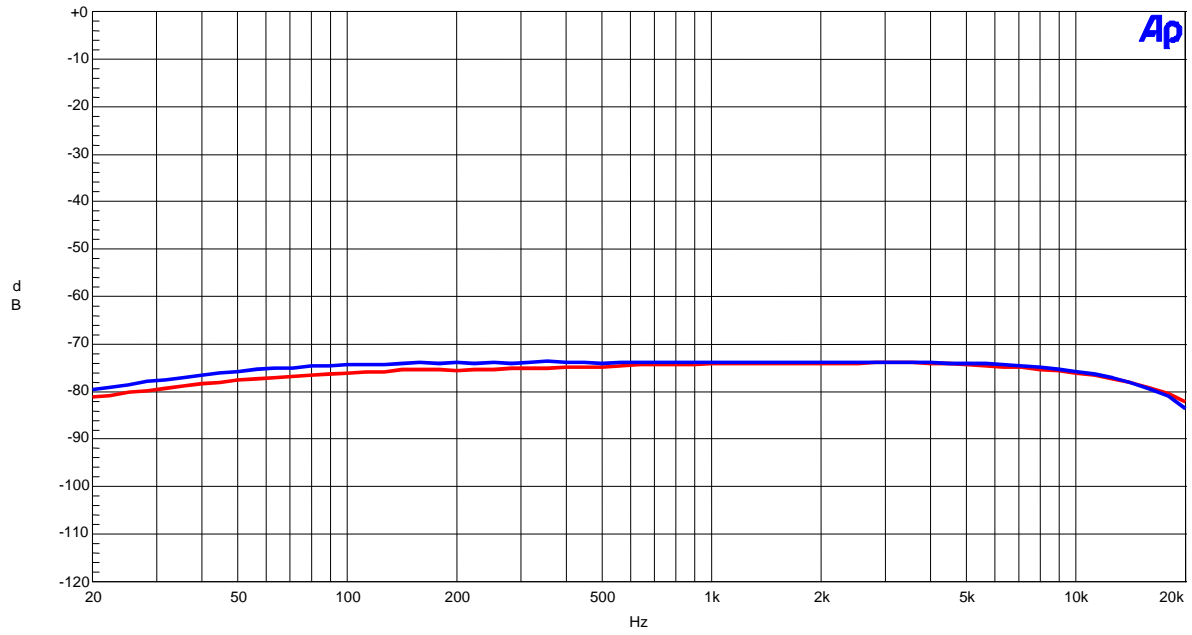
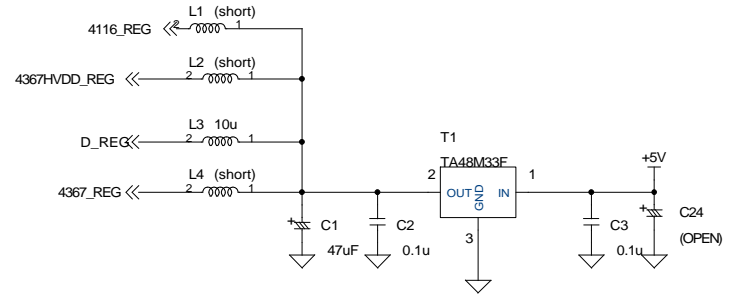
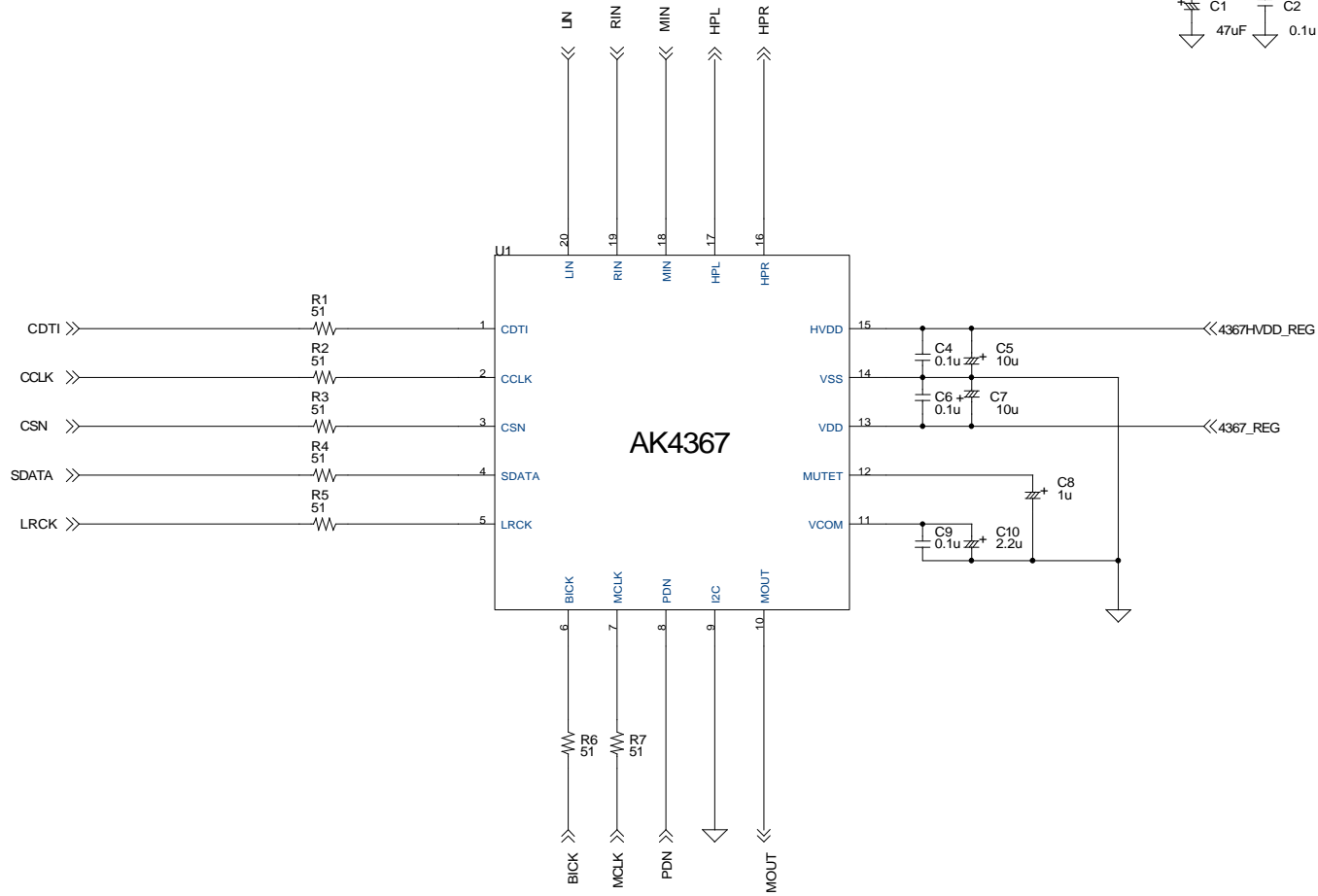
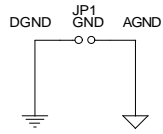


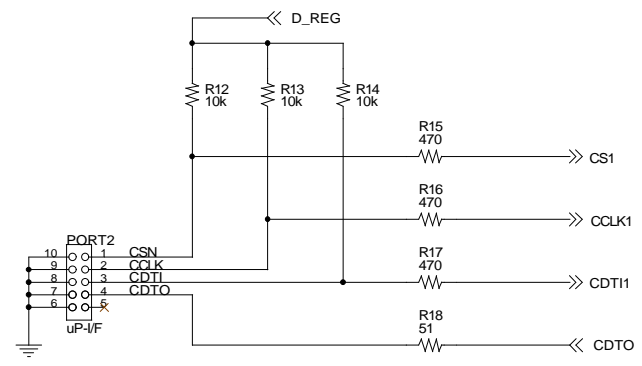
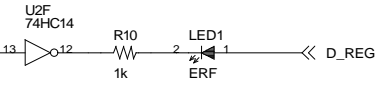
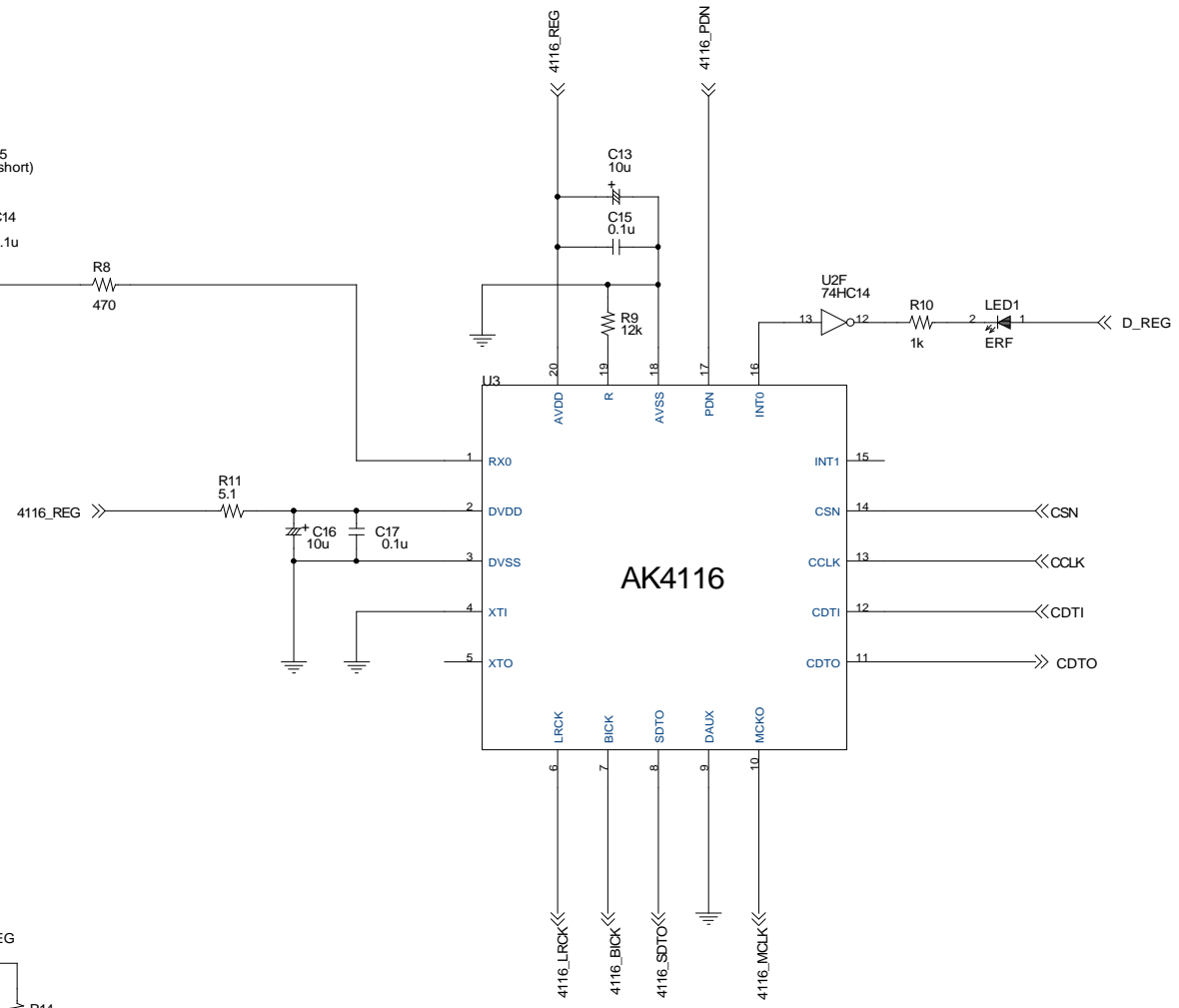
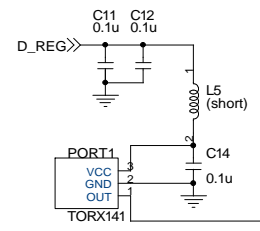
Figure 9. Crosstalk Plot

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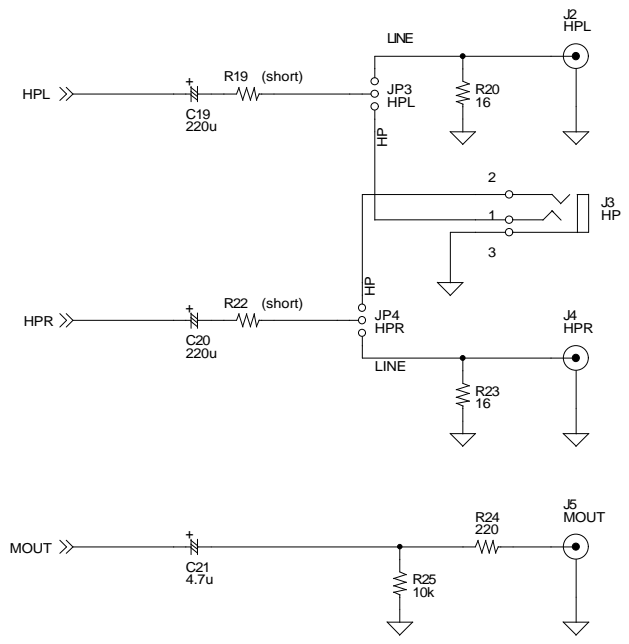
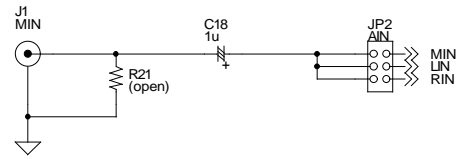
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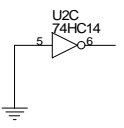
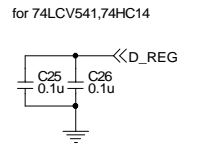
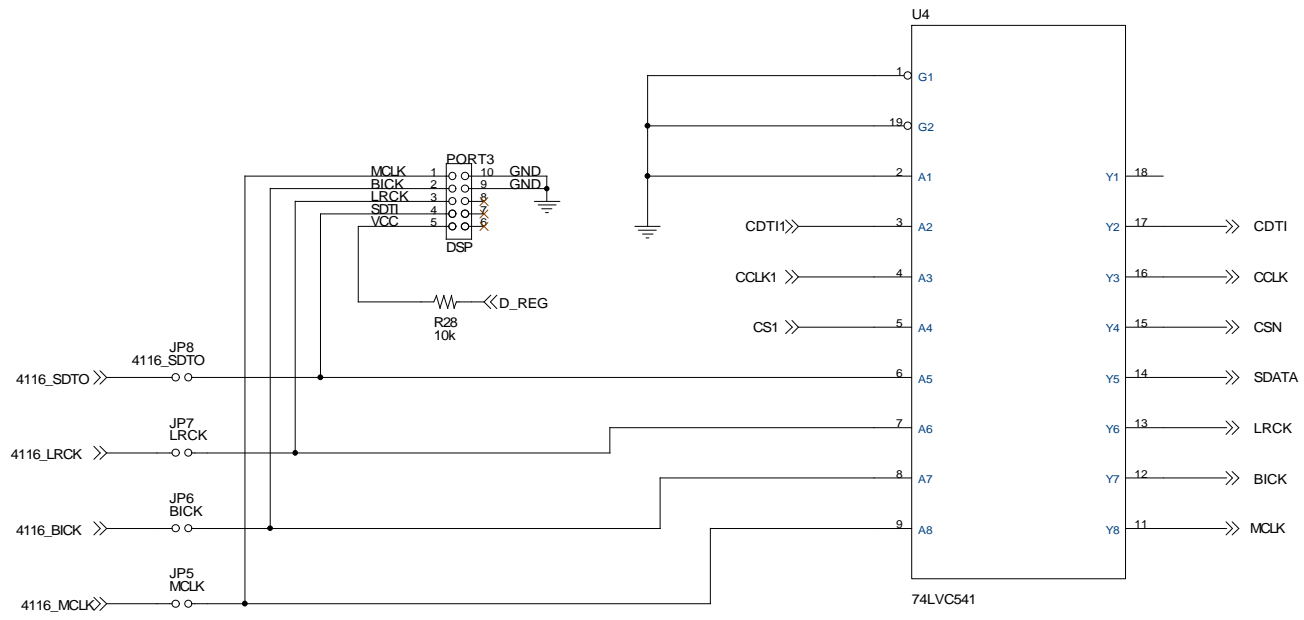
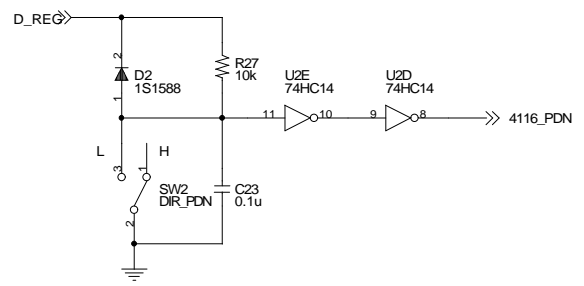
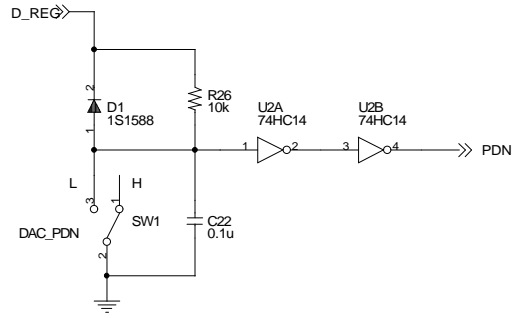
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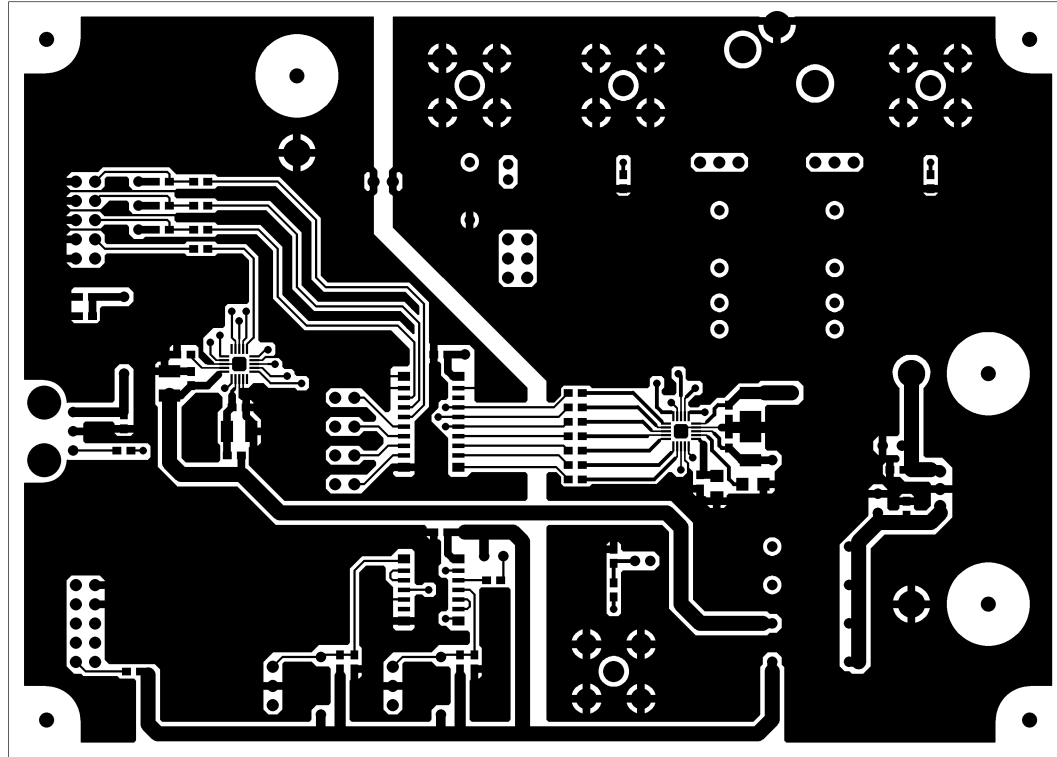
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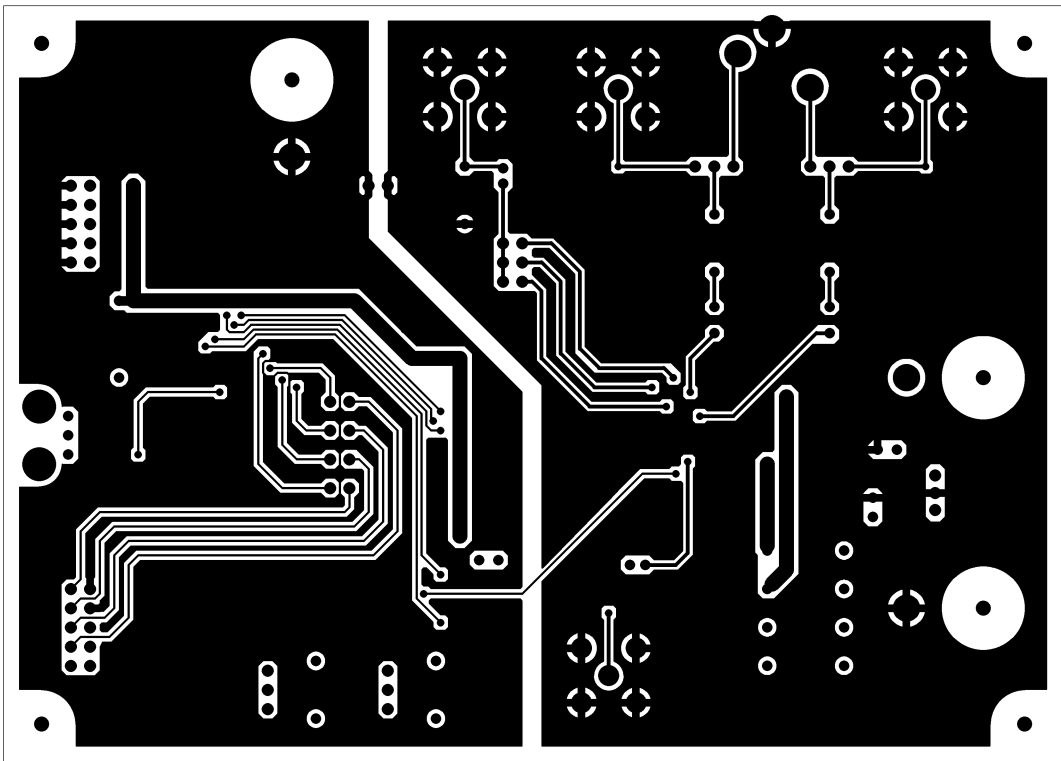
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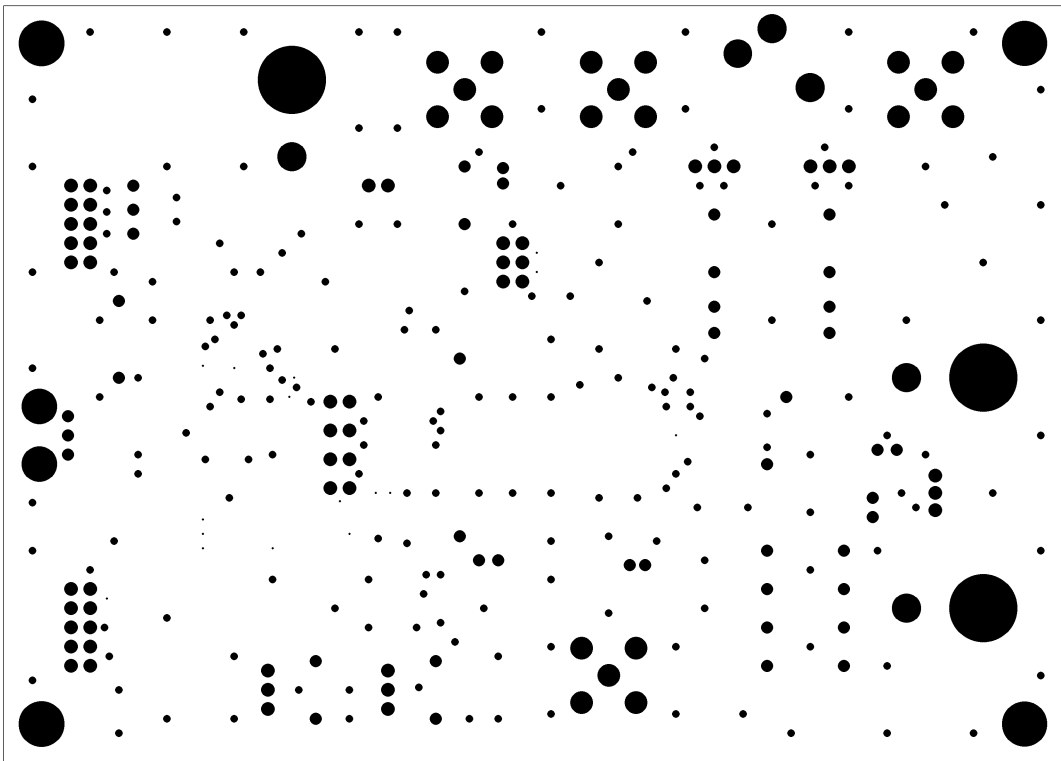


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