



# AKD4642-B

## Evaluation board Rev.0 for AK4642

GENERAL DESCRIPTION

AKD4642-B is an evaluation board for the AK4642, 16bit CODEC with built-in MIC/HP/SPK amplifier. The AKD4642 can evaluate A/D converter and D/A converter separately in addition to loop-back mode (A/D → D/A). The AKD4642 also has the digital audio interface and can achieve the interface with digital audio systems via opt-connector.

**■ Ordering guide**

AKD4642-B --- Evaluation board for AK4642  
 (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

- DIT/DIR with optical input/output
- 10pin Header for serial control mode

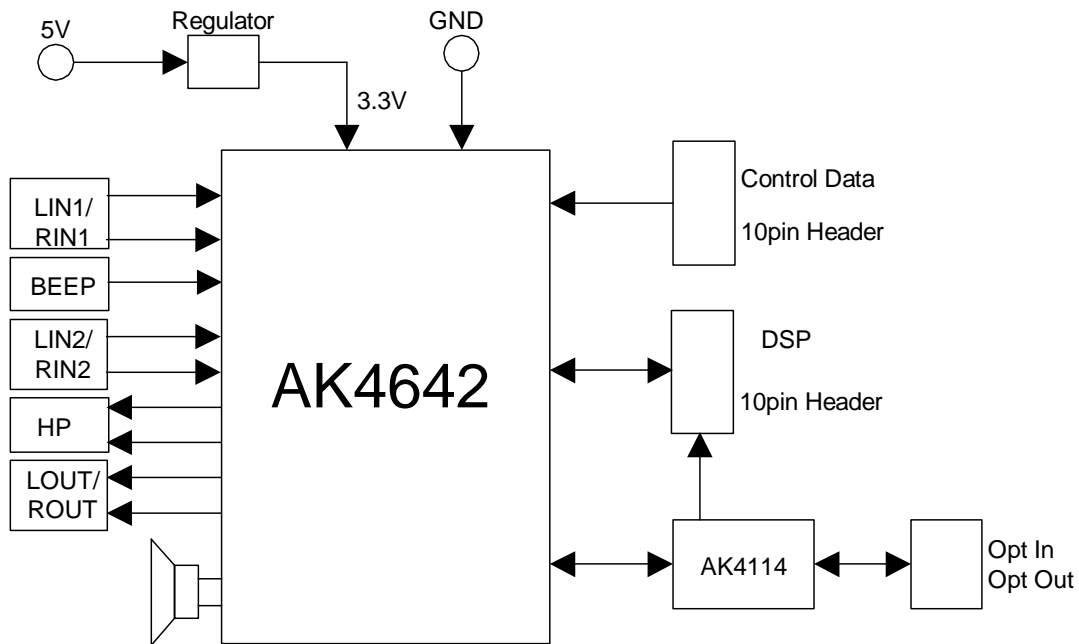


Figure 1. AKD4642 Block Diagram

\* 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.
 

[VCC]	(red)	= 5.0V	: for logic
[AGND]	(black)	= 0V	: for analog ground
[DGND]	(black)	= 0V	: for logic ground

Each supply line should be distributed from the power supply unit.  
3.3V is supplied to AK4642 and AK4114 via the regulator.

- 2) Set up the evaluation mode, jumper pins. (See the followings.)
- 3) Power on.  
The AK4642 and AK4114 should be reset once bringing SW1 “L” upon power-up.

### ■ Evaluation mode

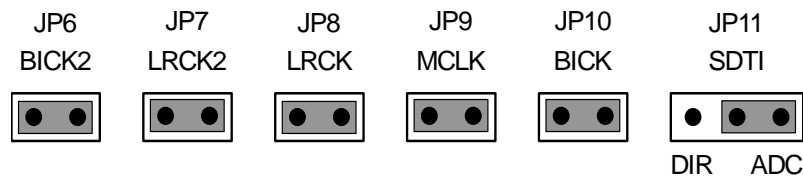
#### (1) Slave mode

- (1-1) Evaluation of Recording block (MIC, ADC) using DIT of AK4114
- (1-2) Evaluation of Playback block (HP, SPK, LOU) using DIR of AK4114
- (1-3) Evaluation of Loop-back using AK4114
- (1-4) All interface signals including master clock are fed externally.

**The AK4114’s audio interface format is fixed to I<sup>2</sup>S compatible.**

#### (1-1) Evaluation of Loop-back using DIT of AK4114

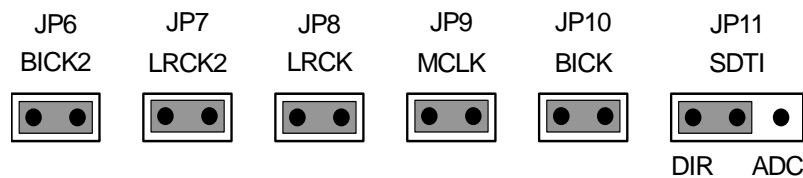
PORT2 (DIT) and X1 (X’tal) are used. DIT generates audio bi-phase signal from received data and which is output through optical connector (TOTX141). Nothing should be connected to PORT1 (DIR) and PORT3 (DSP).



**The AK4642’s audio interface format is left instified at default .  
There fore, DIF1-0 bits should be changed to “11”(I<sup>2</sup>S)**

#### (1-2) Evaluation of Playback block using DIR of AK4114

PORT1 (DIR) is used. Nothing should be connected to PORT3 (DSP).

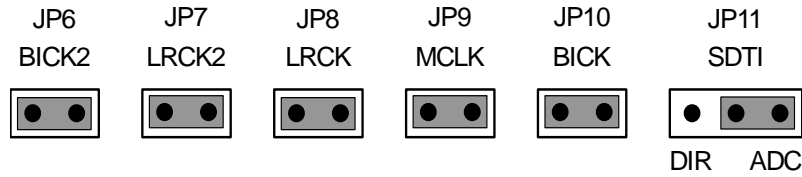


**The AK4642’s audio interface format is left instified at default .  
There fore, DIF1-0 bits should be changed to “11”(I<sup>2</sup>S)**

**The AK4114 operates at fs of 32kHz or more. If the fs is slower than 32kHz,  
any other evaluation mode without using DIR should be used.**

**(1-3) Evaluation of Loop-back using AK4114**

X'tal oscillator (X1) is used. Nothing should be connected to PORT1 (DIR) and PORT3 (DSP).

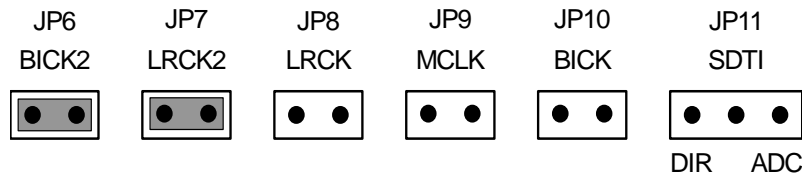


The AK4642's audio interface format is left instified at default .  
 There fore, DIF1-0 bits should be changed to "11"(I<sup>2</sup>S)

The AK4114 operates at fs of 32kHz or more. If the fs is slower than 32kHz,  
 any other evaluation mode without using DIR should be used.

**(1-4) All interface signals including master clock are fed externally.**

PORT3 (DSP) is used. Nothing should be connected to PORT1 (DIR).



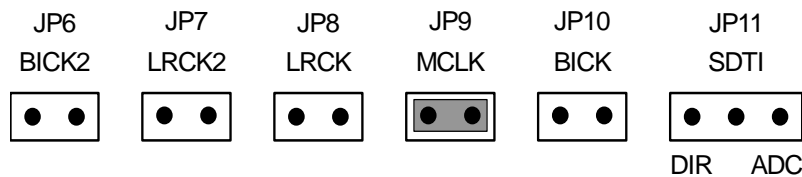
(2) Master mode

(2-1) Evaluation of Recording block using MCLK of AK4114

(2-2) Master clock is fed externally

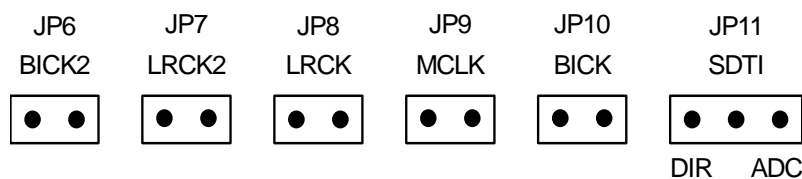
**(2-1) Evaluation of Loop-back using MCLK of AK4114**

X'tal oscillator (X1) is used. Nothing should be connected to PORT1 (DIR) and PORT3 (DSP). It can be evaluated at internal loop-back mode (LOOP bit = "1"). It is possible to evaluate at various sampling frequencies using built-in AK4642's PLL.



**(2-2) Master clock is fed externally**

PORT3 (DSP) is used and MCLK is fed from PORT3. Nothing should be connected to PORT1 (DIR). It can be evaluated at internal loop-back mode (LOOP bit = "1"). It is possible to evaluate at various sampling frequencies using built-in AK4642's PLL.



■ Other jumper pins set up

1. JP1 (GND) : Connection between AGND and DGND.  
 OPEN : Both grounds are separated on board.  
 SHORT : Both grounds are connected on board.
2. JP2,JP3 : Connection of mic power.  
 OPEN: Mic power is not connected.  
 SHORT : Mic power is connected.
3. JP4,JP5 : Select speaker type.  
 OPEN : Piezo speaker  
 SHORT : Dynamic speaker
4. JP12 : Select speaker type.  
 Dynamic: Dynamic speaker  
 Piezo: Piezo speaker

■ The function of the toggle SW

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

[SW1] (PDN): Power down of AK4642 and AK4114. Keep “H” during normal operation.

■ Indication for LED

[LED1] (ERF): Monitor INT0 pin of the AK4114. LED turns on when some error has occurred to AK4114.

■ Serial Control

The AK4642 can be controlled via the printer port (parallel port) of IBM-AT compatible PC. Connect PORT4 (CTRL) with PC by 10 wire flat cable packed with the AKD4642.

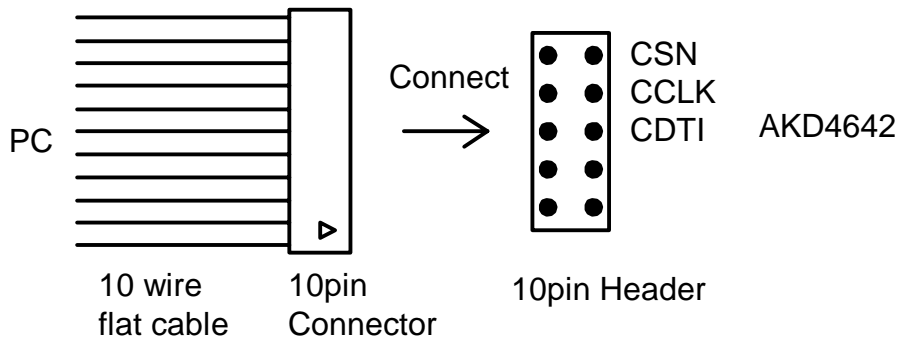


Figure 2. Connect of 10 wire flat cable

### ■ Analog Input/Output Circuits

#### (1) Input Circuits

##### 1. BEEP Input Circuit

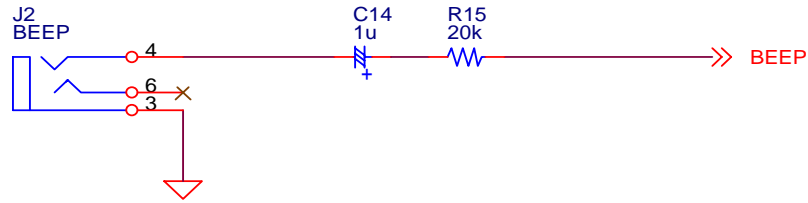


Figure 3. BEEP Input Circuit

##### 2. LINE1 Input Circuit

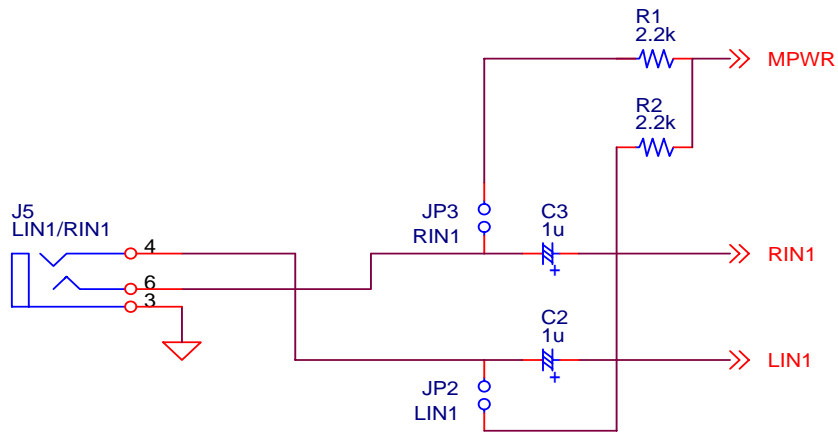


Figure 4. LINE1 Input Circuit

##### 3. LINE2 Input Circuit

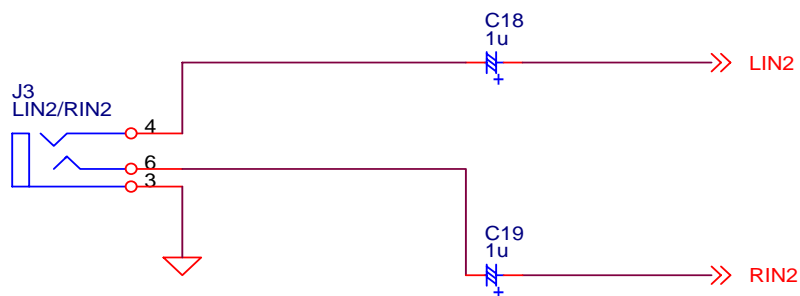


Figure 5. LINE2 Input Circuit

(2) Output Circuits

1. Headphone-amp Output Circuit

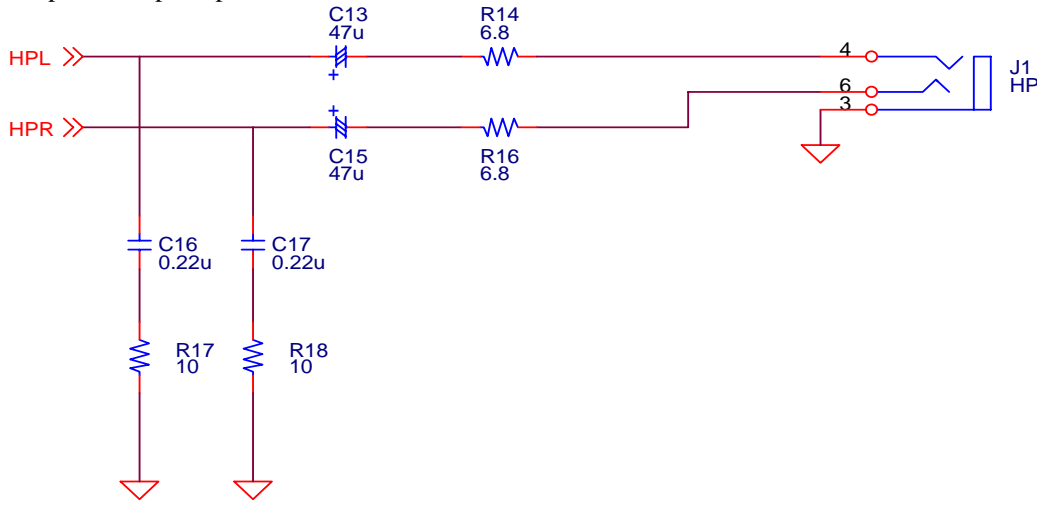


Figure 6. Headphone-amp Output Circuit

3. STEREO LINE Output Circuit

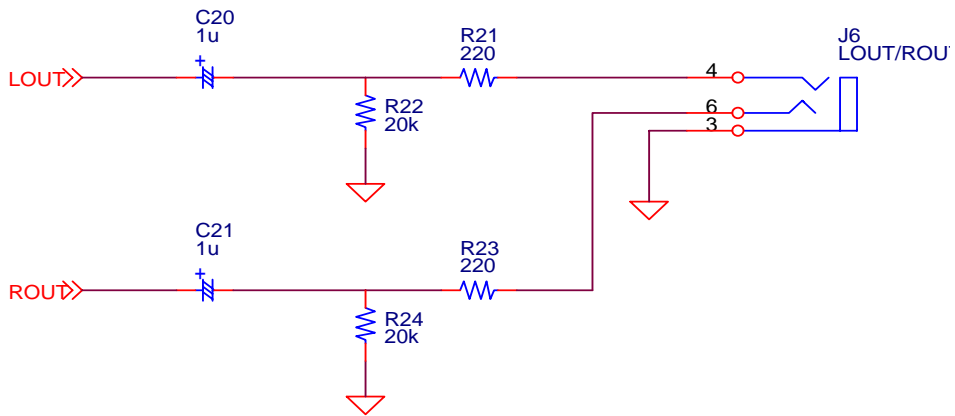


Figure 8. STEREO LINE Output Circuit

4. SPEAKER Output Circuit

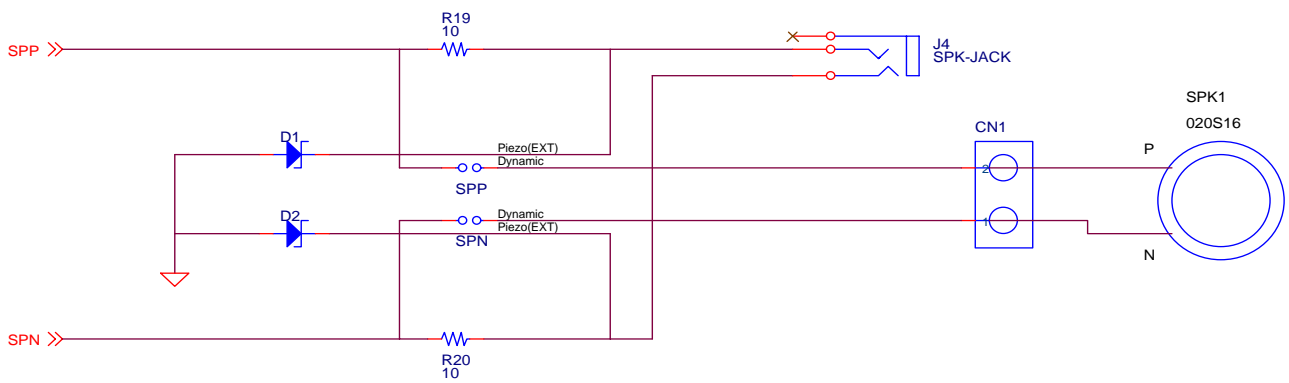


Figure 9. SPEAKER Output Circuit

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

## 2. Control Software Manual

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

1. Set up the AKD4642-B according to previous term.
2. Connect IBM-AT compatible PC with AKD4642-B by 10-line type flat cable (packed with AKD4642-B). 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 "AK4642-B Evaluation Kit" into the CD-ROM drive.
4. Access the CD-ROM drive and double-click the icon of "akd4642.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 Reset" button.

### ■ Explanation of each buttons

1. [Port Reset] : Set up the USB interface board (AKDUSBIF-A) .
2. [Write default] : Initialize the register of AK4642.
3. [All Write] : Write all registers that is currently displayed.
4. [Function1] : Dialog to write data by keyboard operation.
5. [Function2] : Dialog to write data by keyboard operation.
6. [Function3] : The sequence of register setting can be set and executed.
7. [Function4] : The sequence that is created on [Function3] can be assigned to buttons and executed.
8. [Function5]: The register setting that is created by [SAVE] function on main window can be assigned to buttons and executed.
9. [SAVE] : Save the current register setting.
10. [OPEN] : Write the saved values to all register.
11. [Write] : Dialog to write data by mouse operation.

### ■ 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.



## ■ Explanation of each dialog

### 1. [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 AK4642, click [OK] button. If not, click [Cancel] button.

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

Address Box: Input registers address in 2 figures of hexadecimal.

Data Box: Input registers data in 2 figures of hexadecimal.

If you want to write the input data to AK4642, click [OK] button. If not, click [Cancel] button.

### 3. [Function2 Dialog] : Dialog to evaluate IVOL and DVOL

Address Box: Input registers address in 2 figures of hexadecimal.

Start Data Box: Input starts data in 2 figures of hexadecimal.

End Data Box: Input end data in 2 figures of hexadecimal.

Interval Box: Data is written to AK4642 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 AK4642, click [OK] button. If not, click [Cancel] button.

#### 4. [Save] and [Open]

##### 4-1. [Save]

Save the current register setting data. The extension of file name is “akr”.

(Operation flow)

- (1) Click [Save] Button.
- (2) Set the file name and push [Save] Button. The extension of file name is “akr”.

##### 4-2. [Open]

The register setting data saved by [Save] is written to AK4642. The file type is the same as [Save].

(Operation flow)

- (1) Click [Open] Button.
- (2) Select the file (\*.akr) and Click [Open] Button.

**5. [Function3 Dialog]**

The sequence of register setting can be set and executed.

(1) Click [F3] Button.

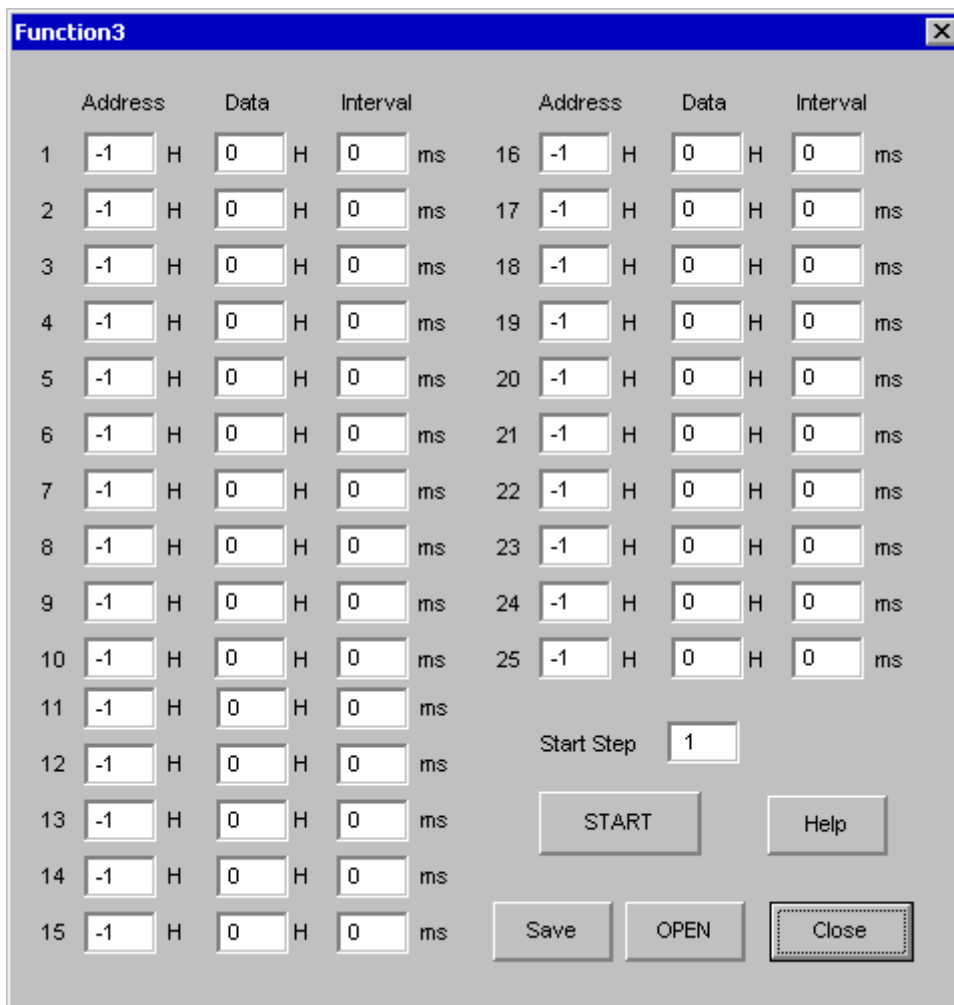
(2) Set the control sequence.

Set the address, Data and Interval time. Set "-1" to the address of the step where the sequence should be paused.

(3) Click [Start] button. Then this sequence is executed.

The sequence is paused at the step of Interval="-1". Click [START] button, the sequence restarts from the paused step.

This sequence can be saved and opened by [Save] and [Open] button on the Function3 window. The extension of file name is "aks".



**Figure 1. Window of [F3]**

### 6. [Function4 Dialog]

The sequence that is created on [Function3] can be assigned to buttons and executed. When [F4] button is clicked, the window as shown in Figure 2 opens.

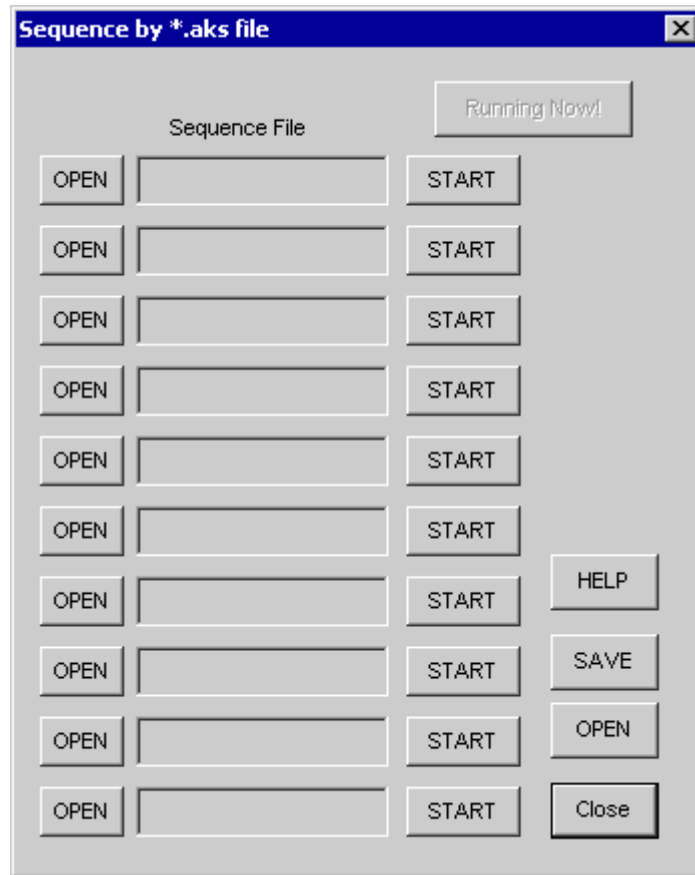


Figure 2. [F4] window

6-1. [OPEN] buttons on left side and [START] buttons

(1) Click [OPEN] button and select the sequence file (\*.aks).

The sequence file name is displayed as shown in Figure 3.

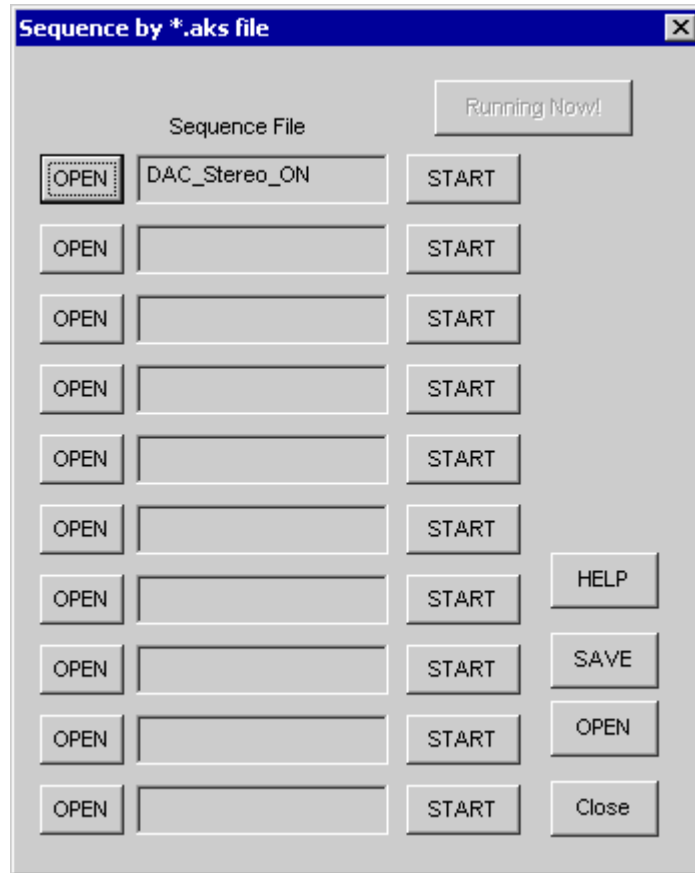


Figure 3. [F4] window(2)

(2) Click [START] button, then the sequence is executed.

3-2. [SAVE] and [OPEN] buttons on right side

[SAVE] : The sequence file names can assign be saved. The file name is \*.ak4.

[OPEN] : The sequence file names assign that are saved in \*.ak4 are loaded.

3-3. Note

(1) This function doesn't support the pause function of sequence function.

(2) All files need to be in same folder used by [SAVE] and [OPEN] function on right side.

(3) When the sequence is changed in [Function3], the file should be loaded again in order to reflect the change.

## 7. [Function5 Dialog]

The register setting that is created by [SAVE] function on main window can be assigned to buttons and executed. When [F5] button is clicked, the following window as shown in Figure 4 opens.

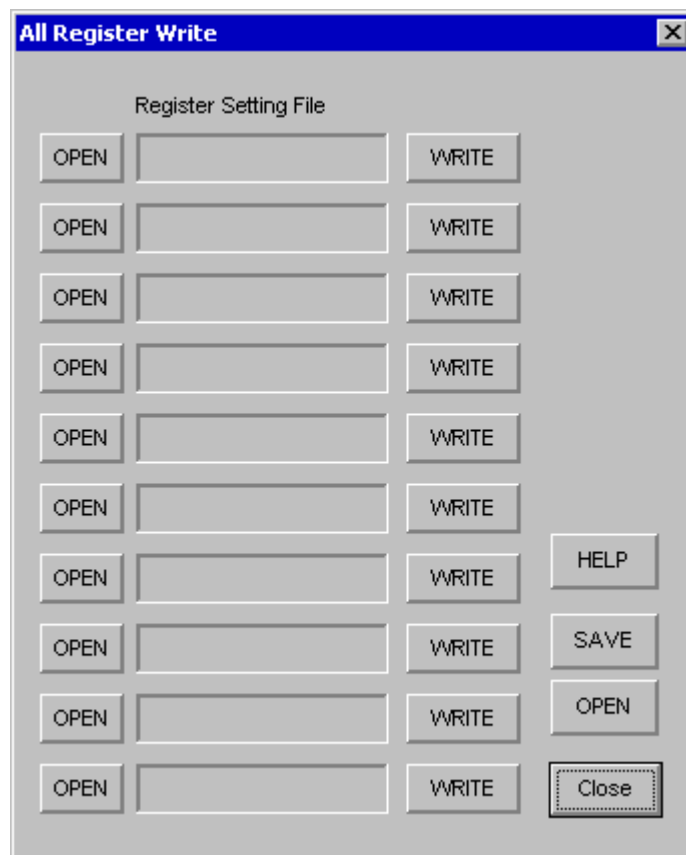


Figure 4. [F5] window

### 7-1. [OPEN] buttons on left side and [WRITE] button

(1) Click [OPEN] button and select the register setting file (\*.akr).

The register setting file name is displayed as shown in Figure 5.

(2) Click [WRITE] button, then the register setting is executed.

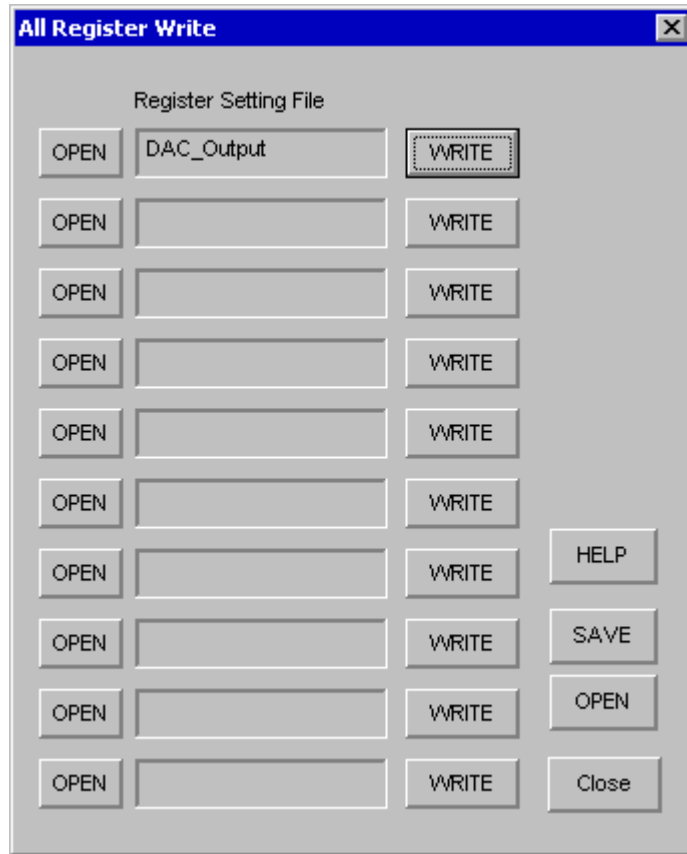


Figure 5. [F5] windows(2)

7-2. [SAVE] and [OPEN] buttons on right side

[SAVE] : The register setting file names assign can be saved. The file name is \*.ak5.

[OPEN] : The register setting file names assign that are saved in \*.ak5 are loaded.

7-3. Note

- (1) All files need to be in same folder used by [SAVE] and [OPEN] function on right side.
- (2) When the register setting is changed by [Save] Button in main window, the file should be loaded again in order to reflect the change.

<b>MEASUREMENT RESULTS</b>
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**1. EXT mode (slave mode)**

[Measurement condition]

- Measurement unit: Audio Precision, System two
- BICK: 64fs
- Bit: 16bit
- Measurement Frequency: 20~ 20kHz
- Power Supply: AVDD=DVDD=HVDD=3.3V
- Temperature: Room
- Input Frequency: 1kHz
- Sampling Frequency: 44.1kHz

[Measurement Results]

**2. ADC (LIN2/RIN2) characteristics (IVOL=0dB, ALC1 = OFF, LIN2/RIN2 → ADC → IVOL)**

		L[dB]		R[dB]	
MGAIN Bit		00	01	00	01
THD+N	20kHzLPF (-1dB)	87.3	82.9	87.1	82.7
DR	20kHzLPF + A-weighted	94.9	86.3	94.9	86.1
S/N	20kHzLPF + A-weighted	95.0	86.2	95.1	86.0

**3. DAC (LOUT/ROUT) characteristics (RL=10kΩ, DAC → LOUT/ROUT)**

		L[dB]	R[dB]
THD+N	20kHzLPF (-3dB)	87.5	87.6
S/N	20kHzLPF + A-weighted	92.0	93.4



2. PLOT DATA

2-1.ADC (LIN2/RIN2 → ADC) PLOT DATA

AKM

AK4642 THD+N vs. Input Level LIN2/RIN2

09/17/04 10:16:26

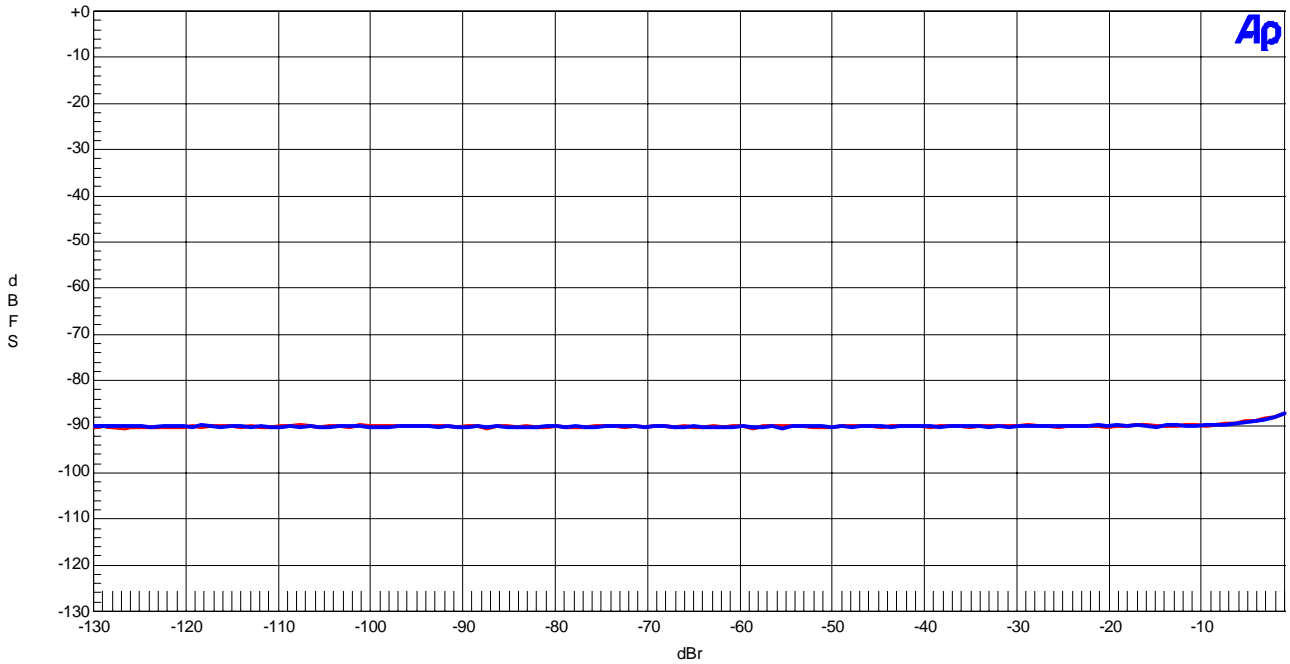


Figure 10. THD+N vs. Input Level

AKM

AK4642 THD+N vs. fin LIN2/RIN2

09/15/04 18:17:10

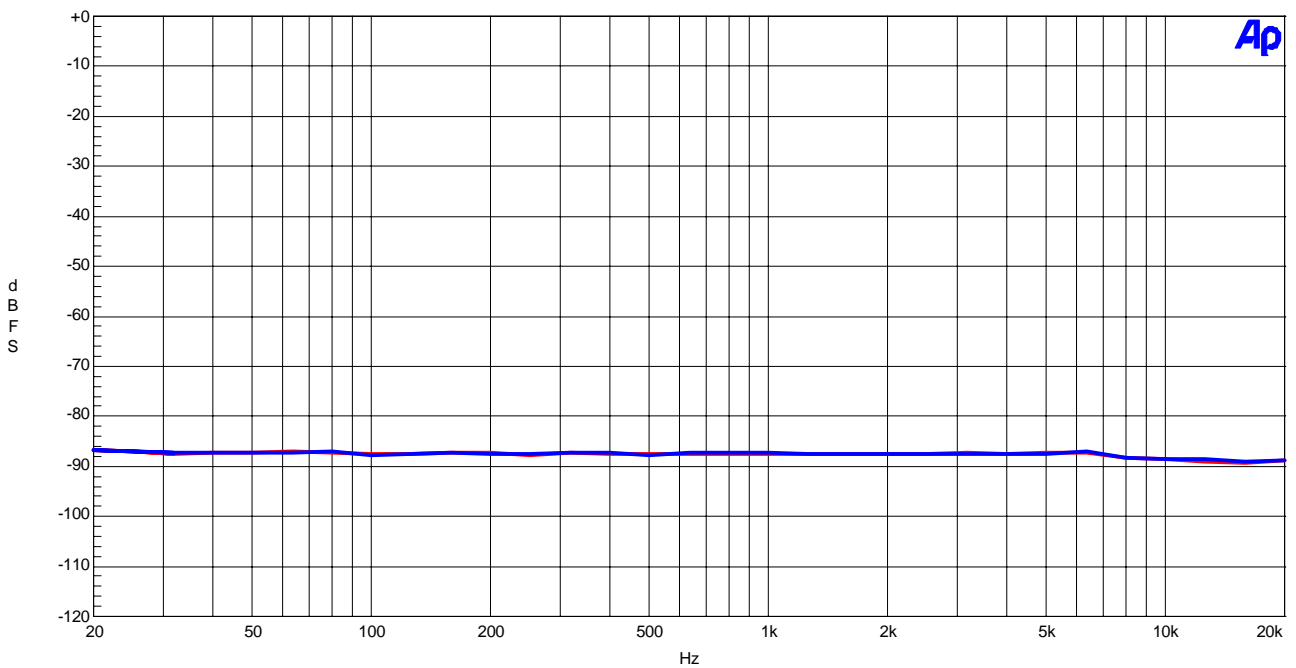


Figure 11. THD+N vs. Input Frequency

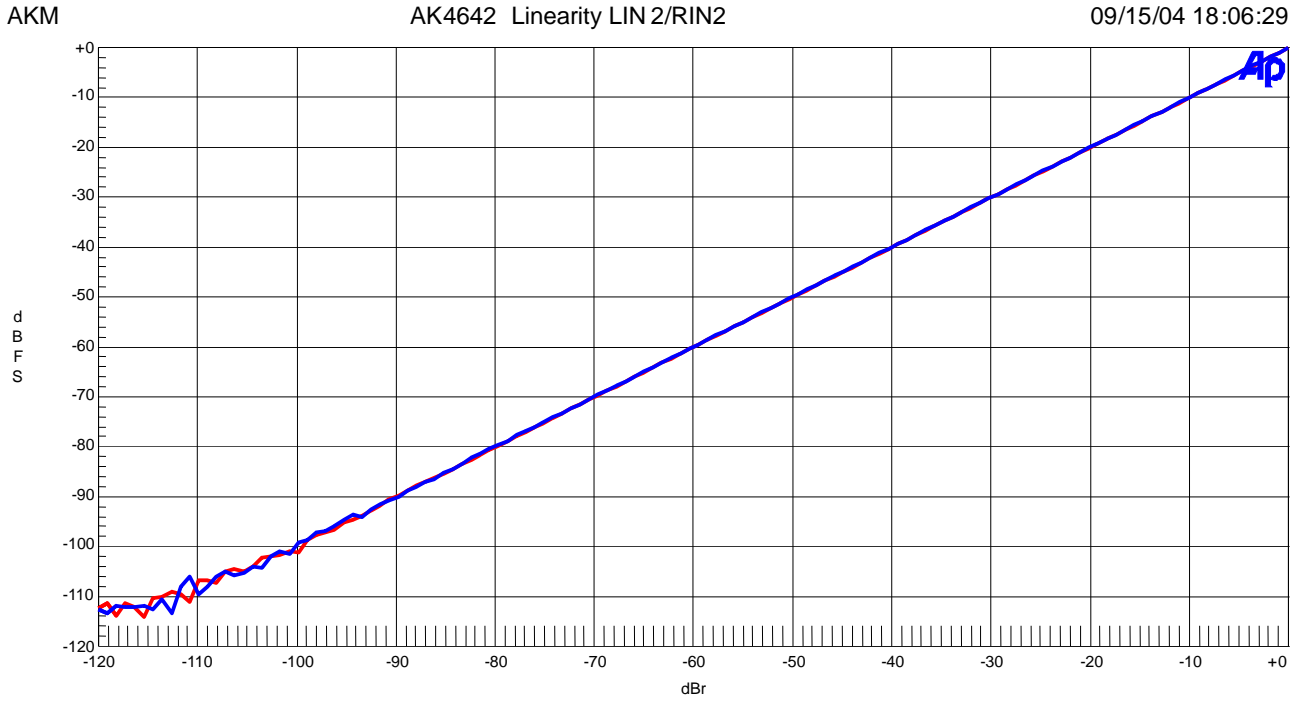


Figure 12. Linearity

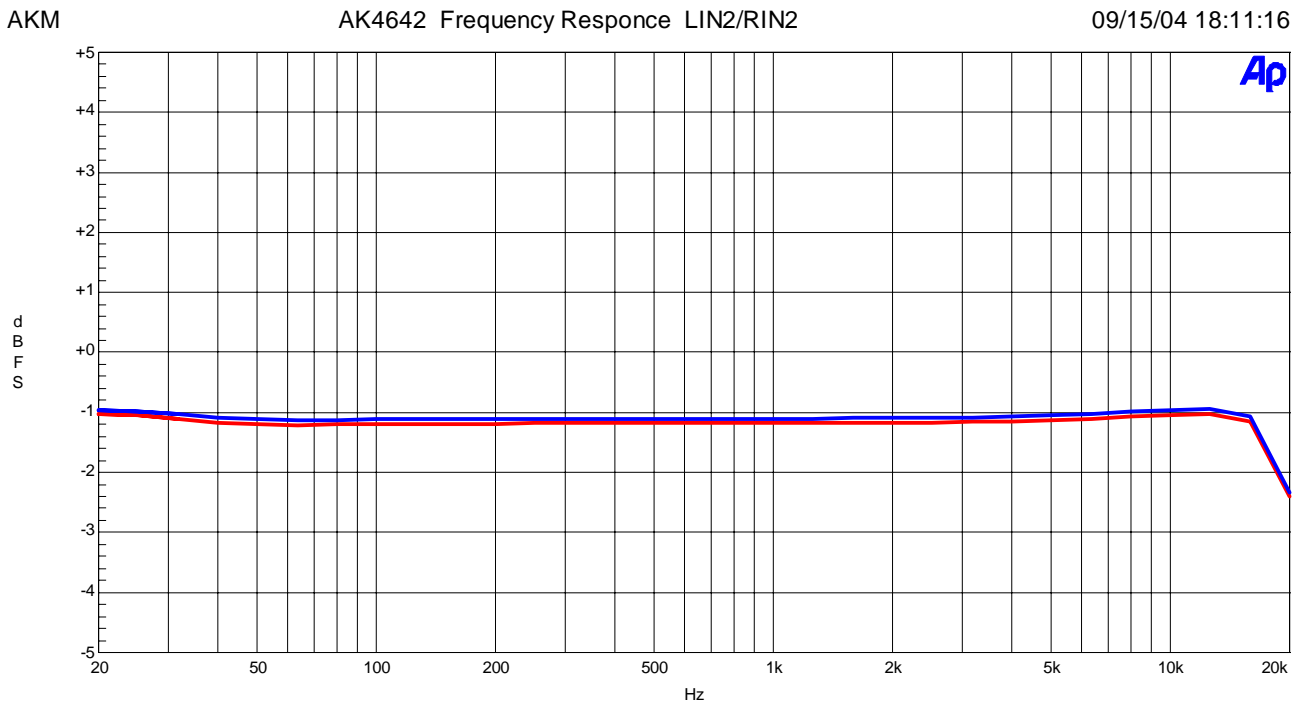


Figure 13 Frequency Response

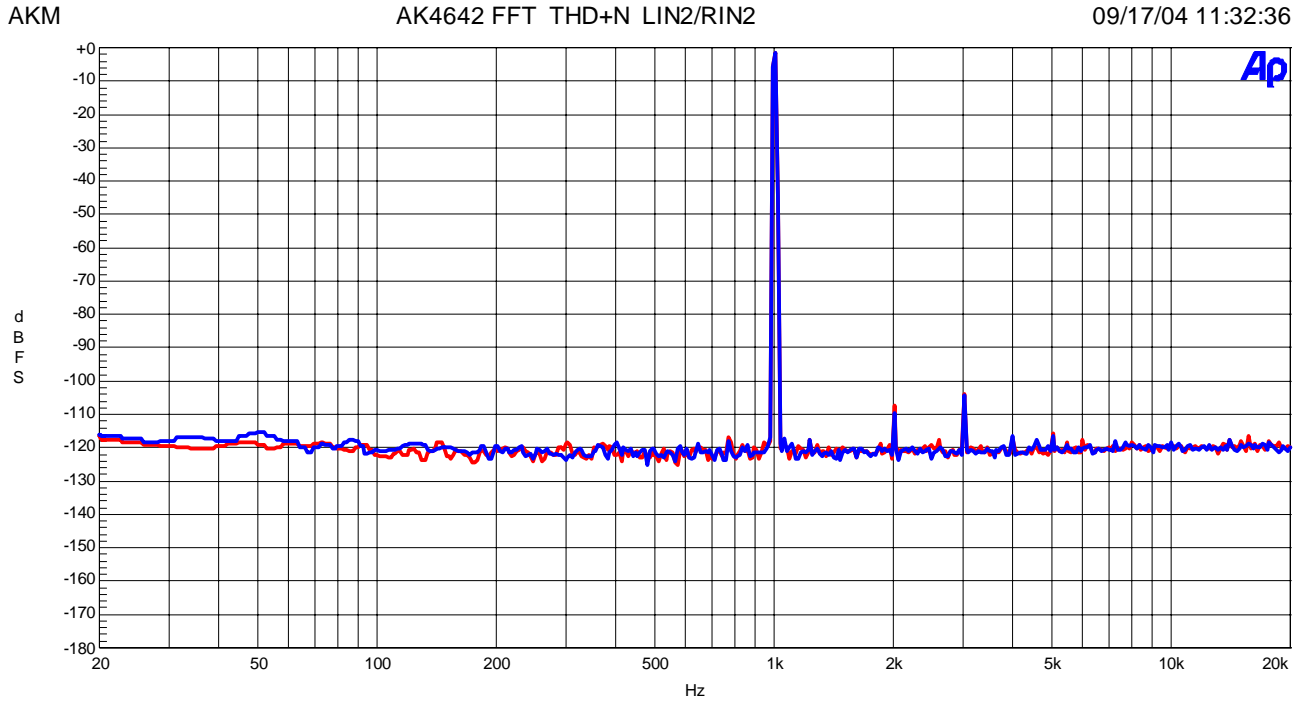


Figure 14. FFT Plot ( Input level=-1.0dBFS)

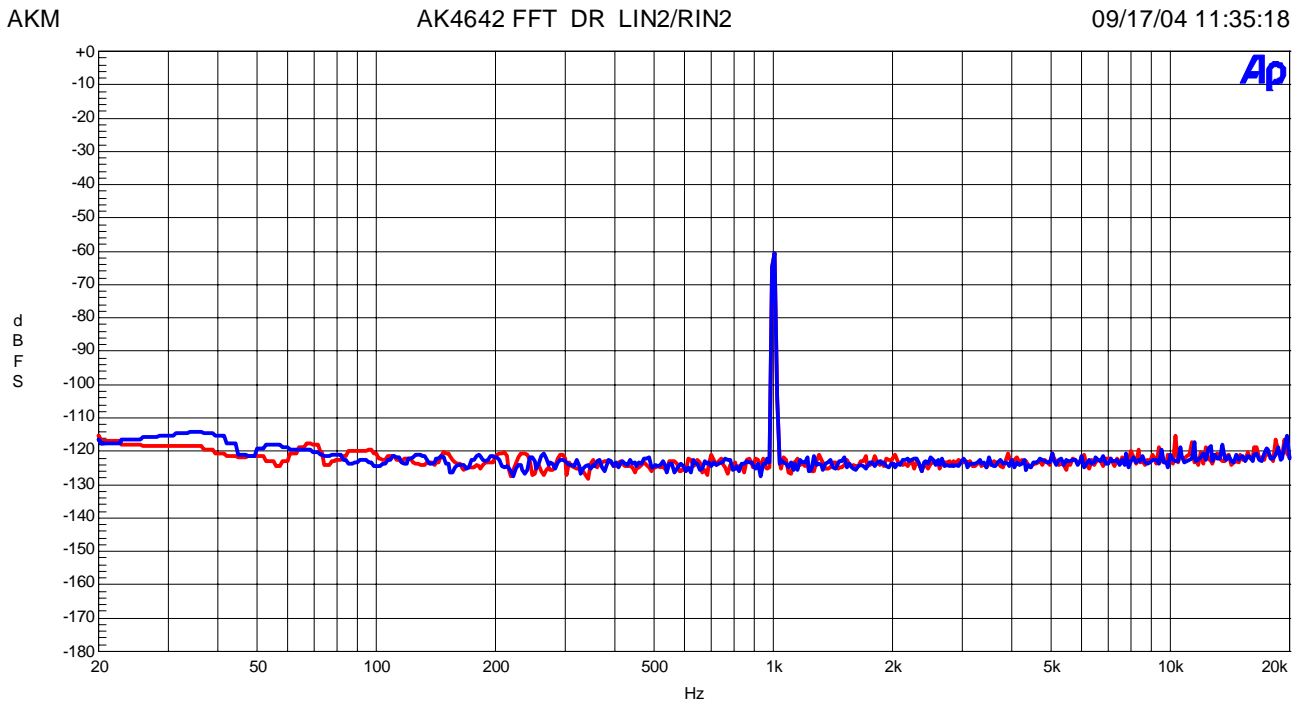


Figure 15. FFT Plot ( Input level=-60.0dBFS )

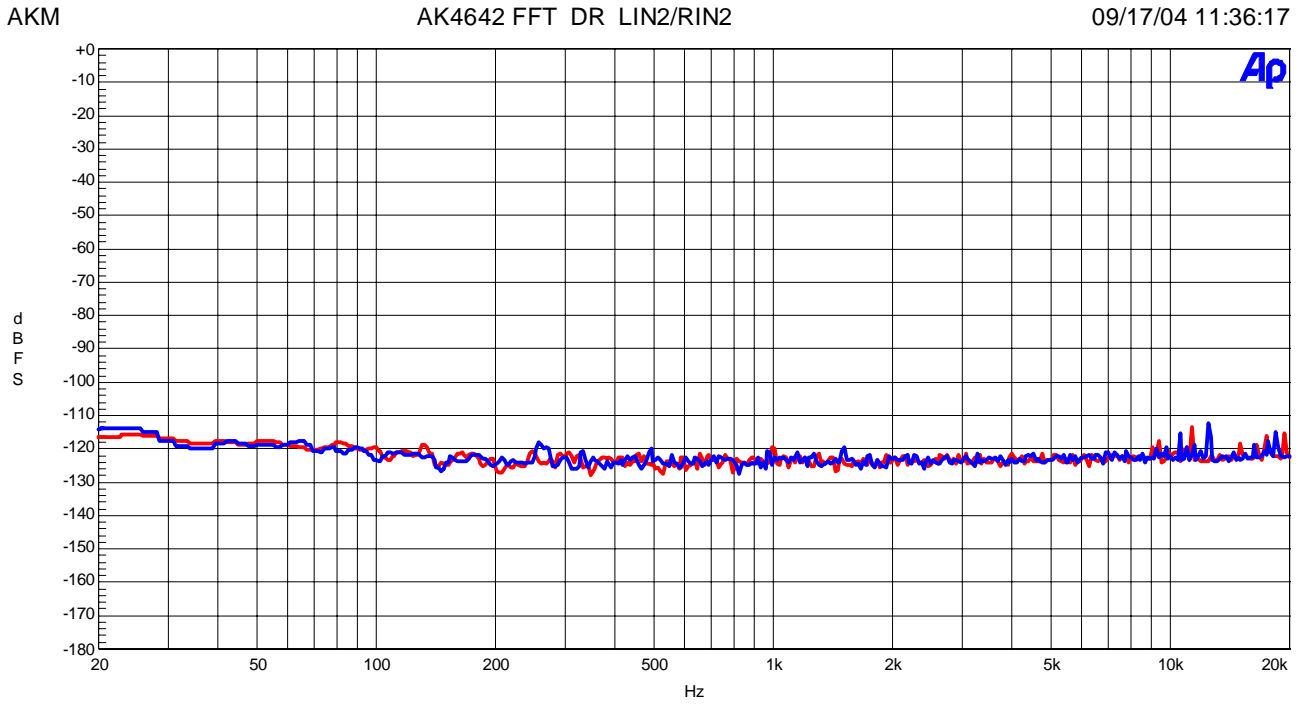


Figure 16. FFT Plot ( No signal )

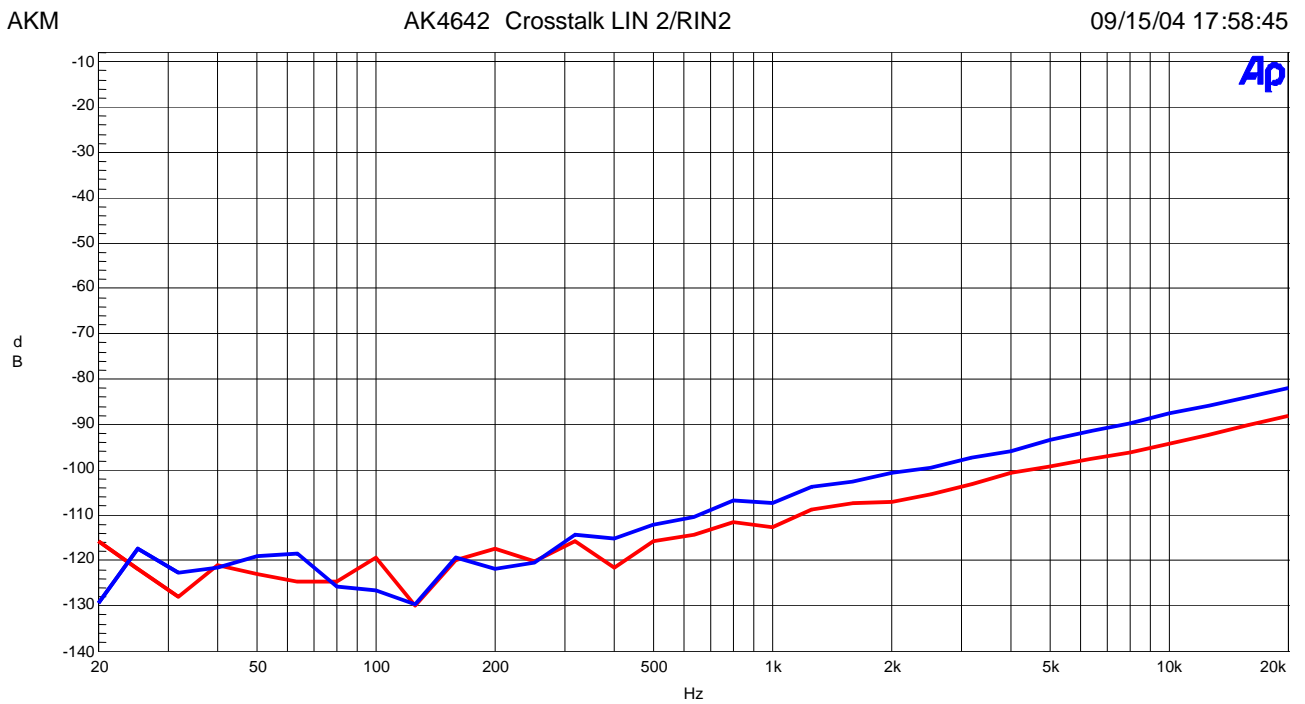


Figure 17. Crosstalk Plot

2-2. DAC(DAC → LOU/ROUT) PLOT DATA

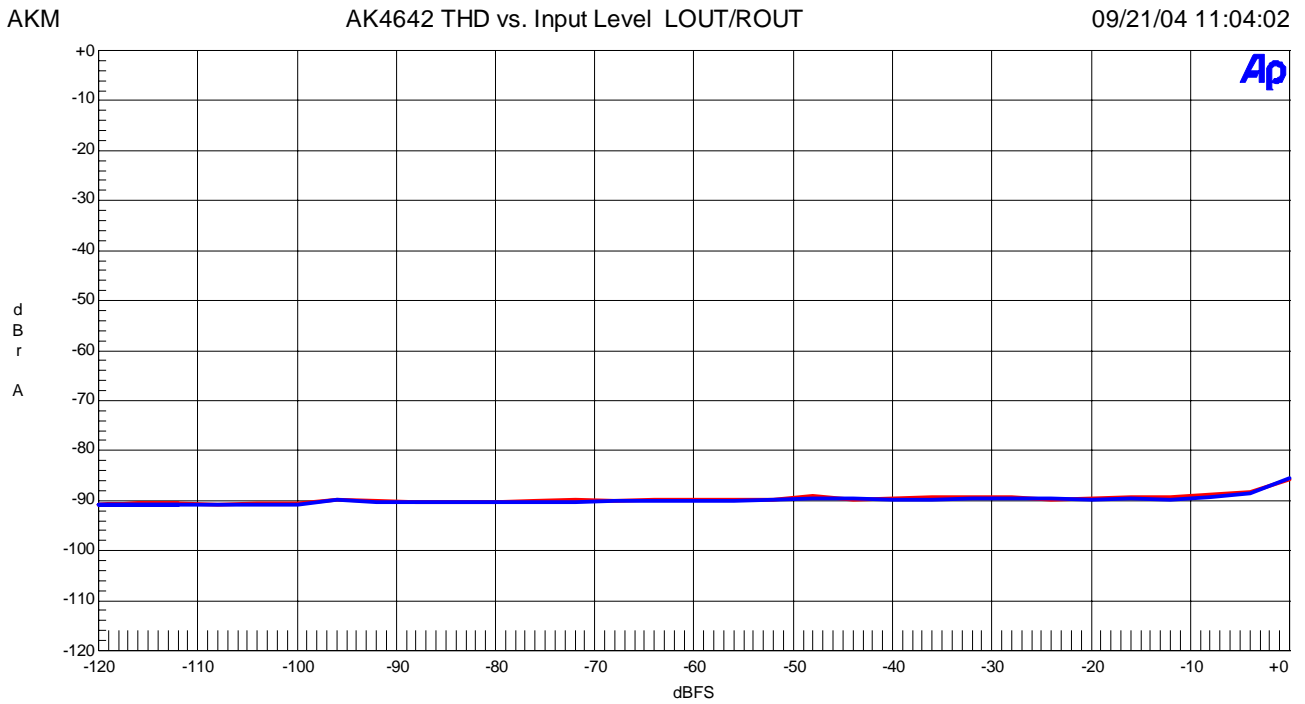


Figure 18. THD+N vs. Input Level

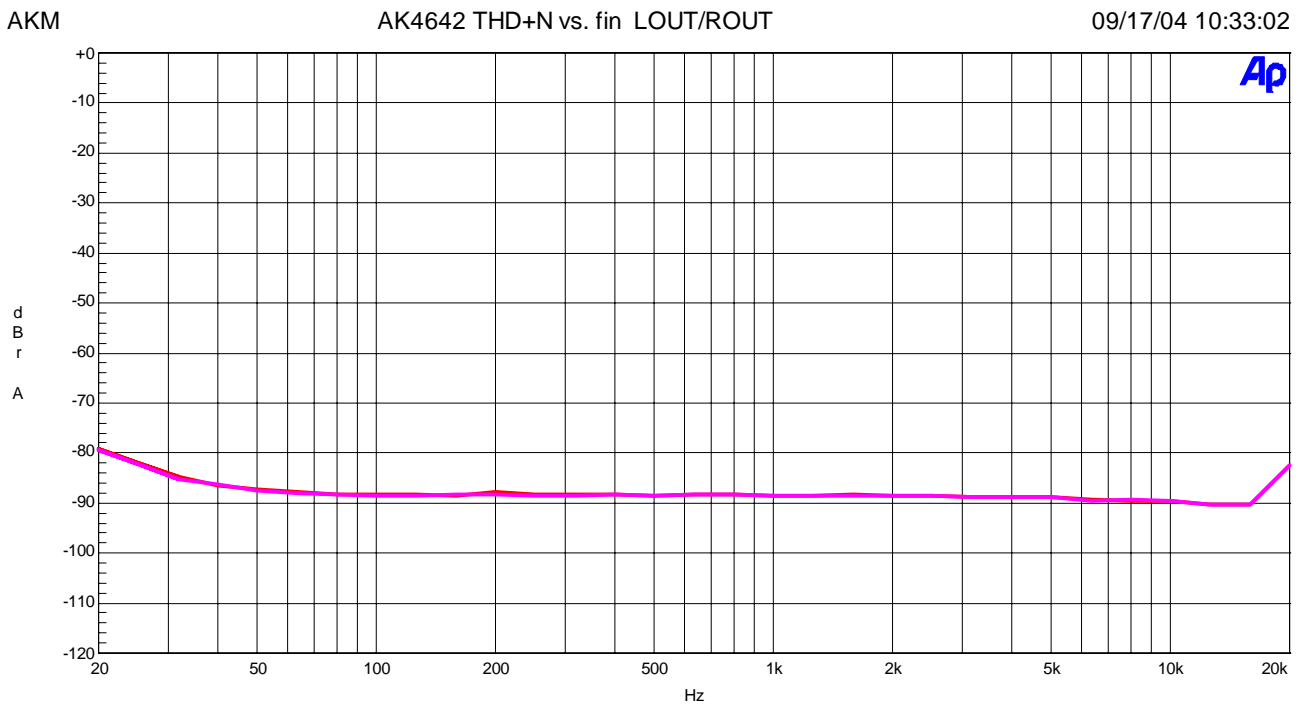


Figure 19. THD+N vs. Input Frequency

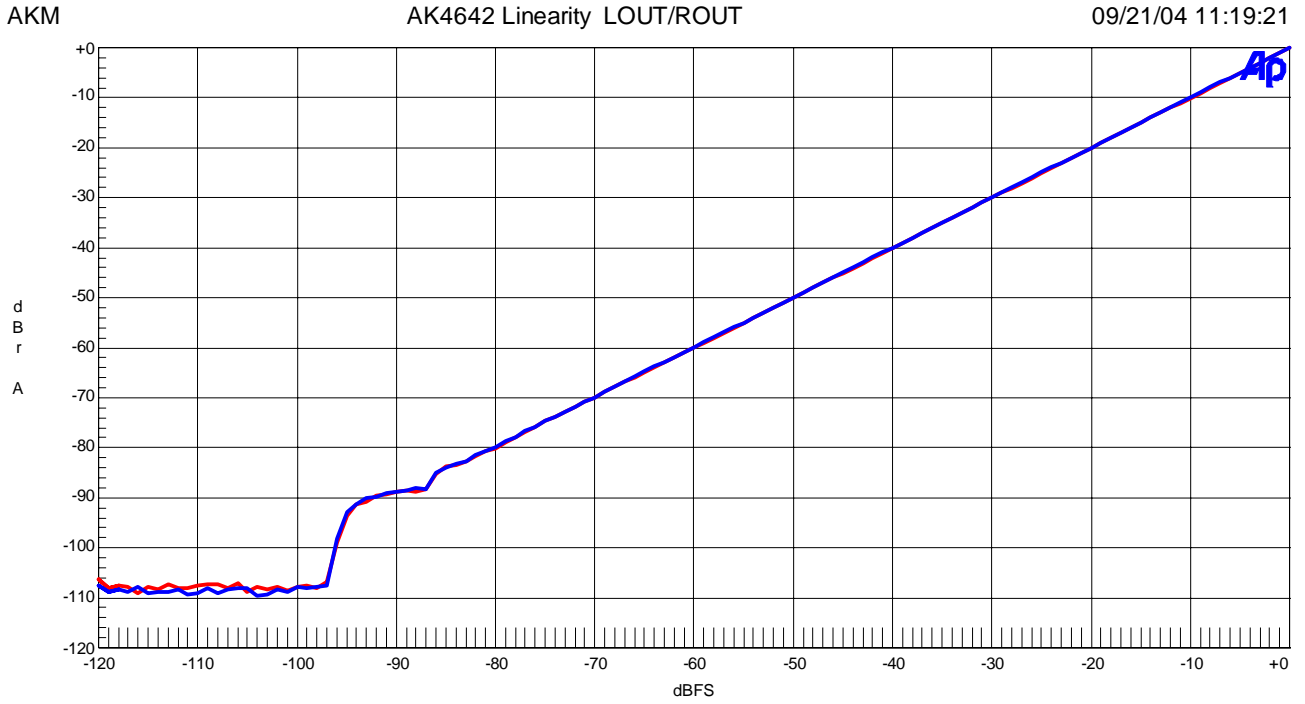


Figure 20 Linearity

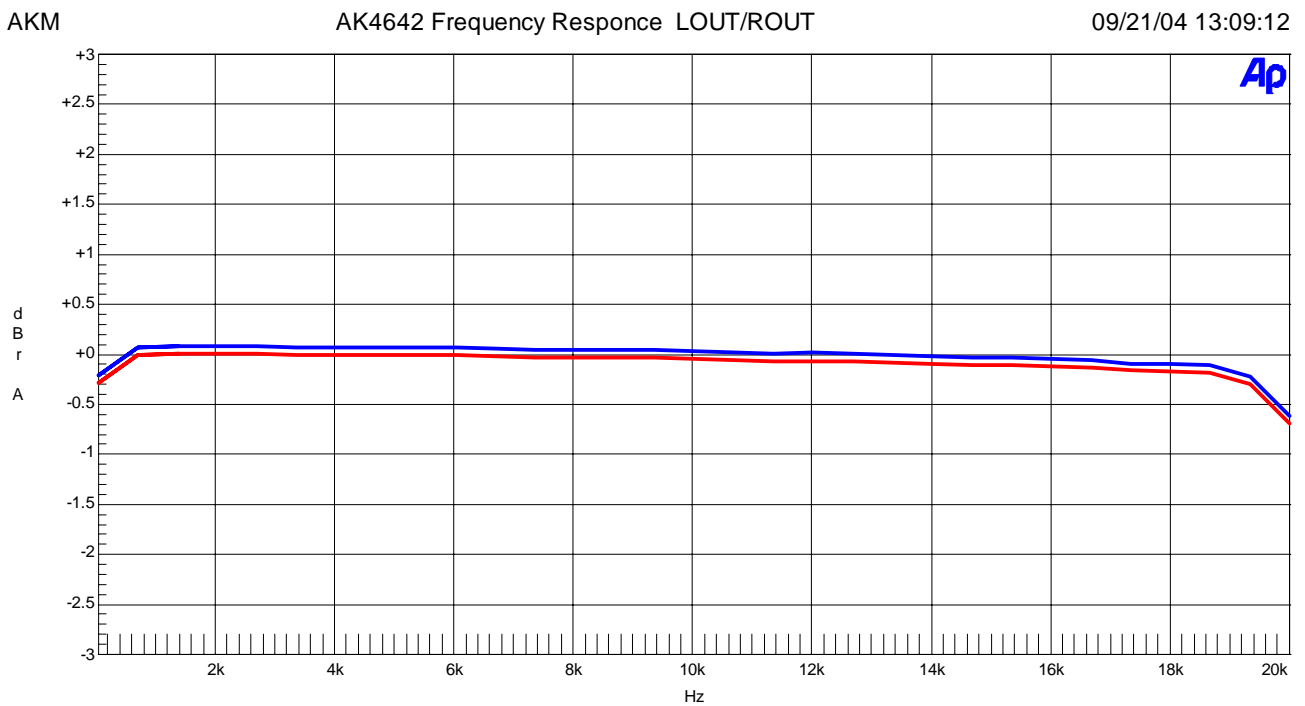


Figure 21. Frequency Response

AKM

AK4642 FFT THD+N LOUT/ROUT

09/21/04 10:51:51

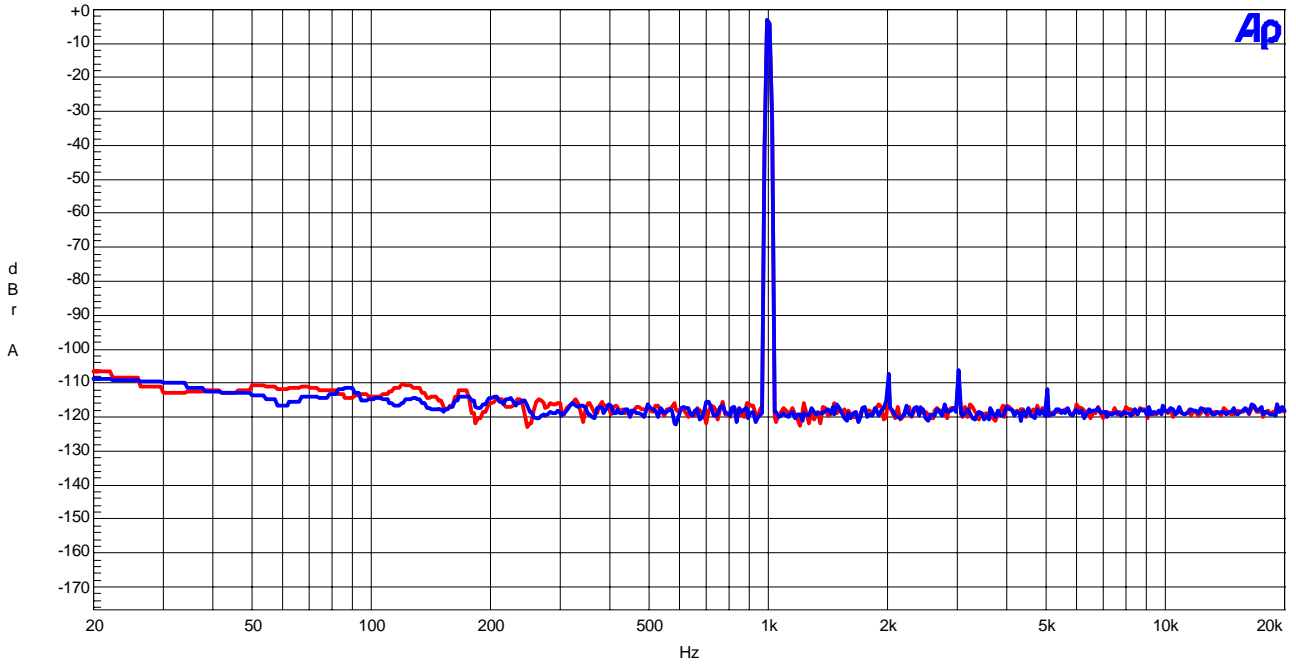


Figure 22. FFT Plot ( Input level=-3dBFS )

AKM

AK4642 FFT DR LOUT/ROUT

09/21/04 10:53:54

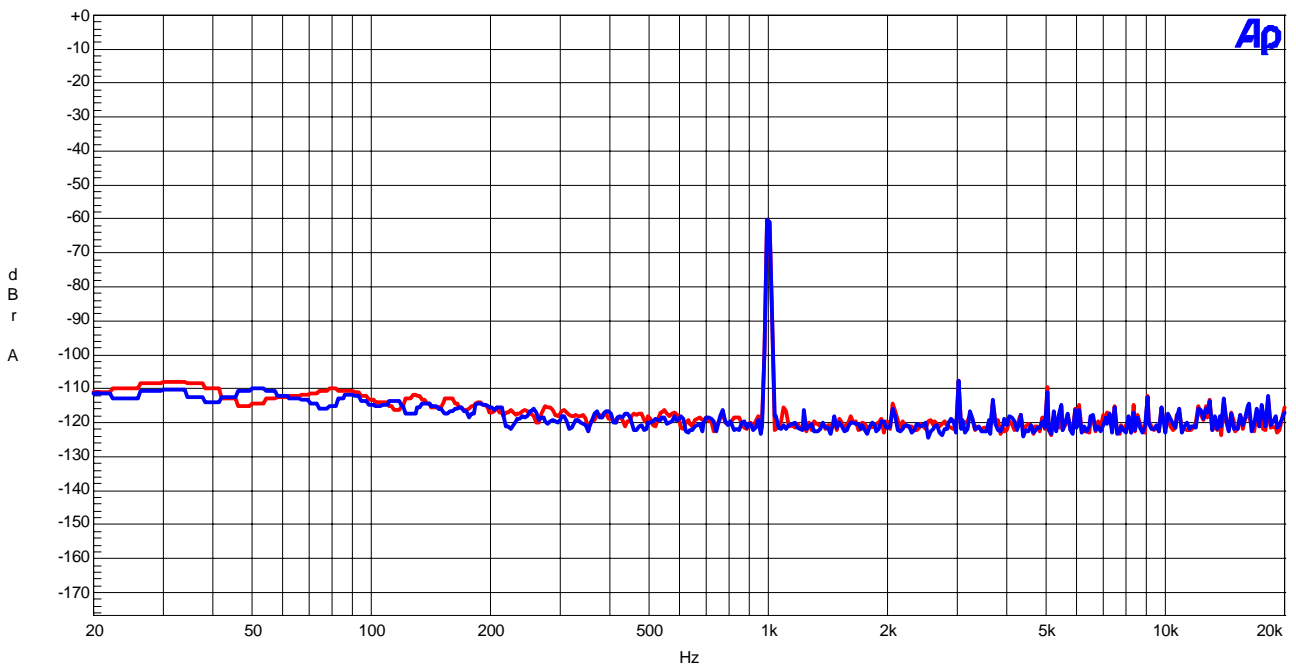


Figure 23. FFT Plot ( Input level=-60.0dBFS )

AKM

AK4642 FFT S/N LOUT/ROUT

09/21/04 10:55:10

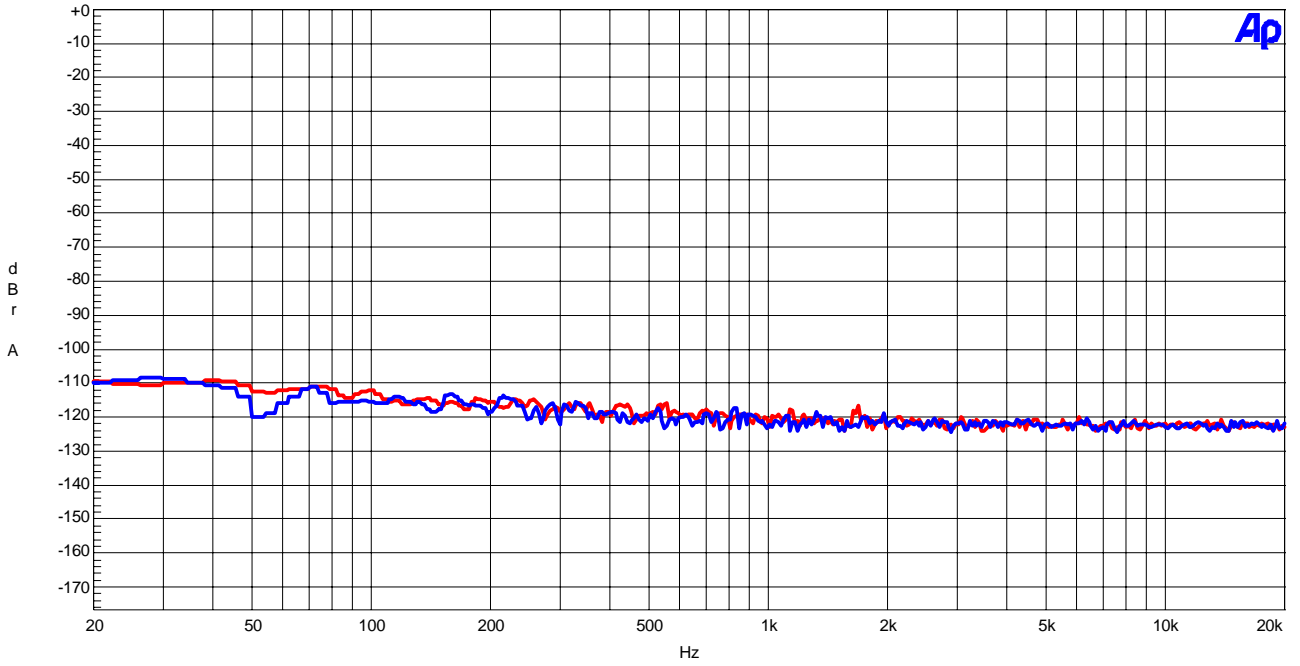


Figure 24. FFT Plot ( No signal )

AKM

AK4642 Crosstalk LOUT /ROUT

09/15/04 19:30:36

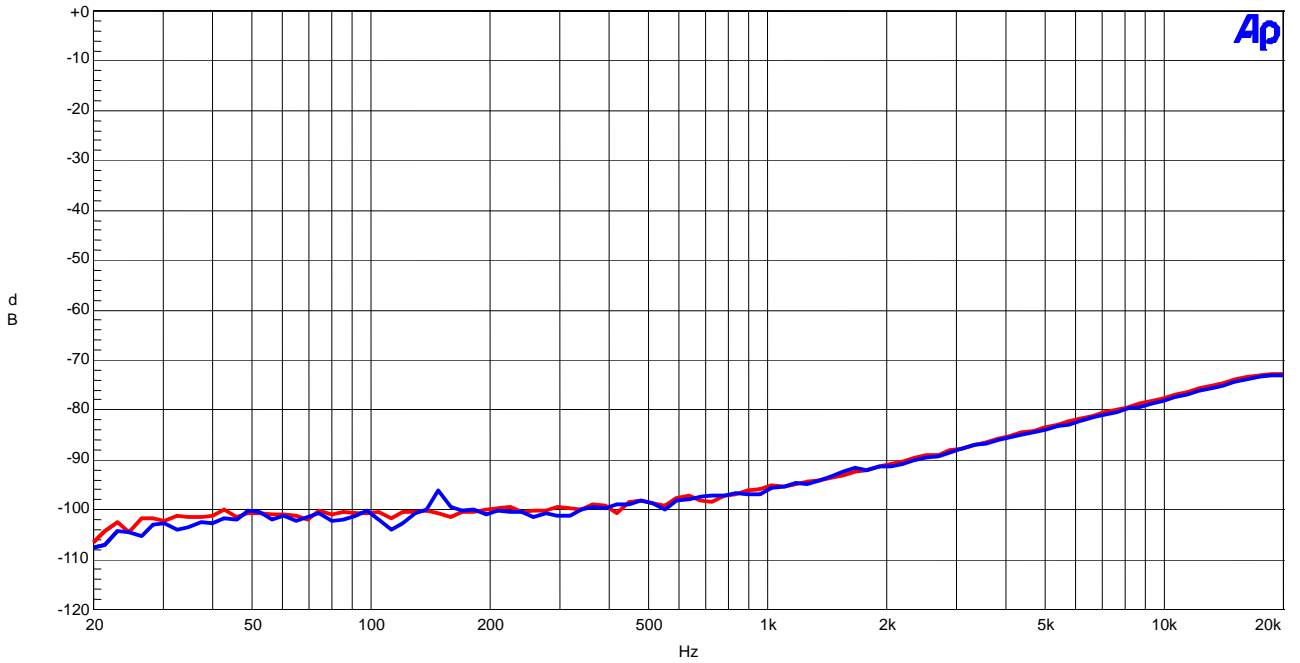


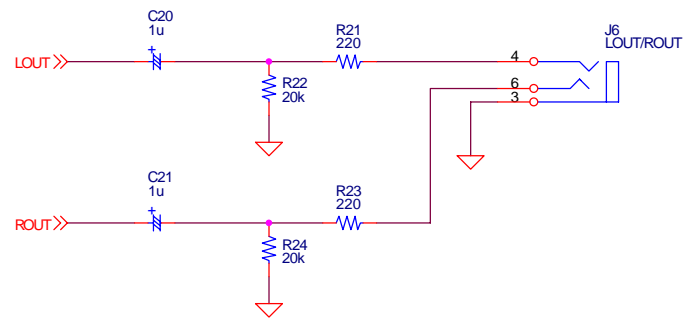
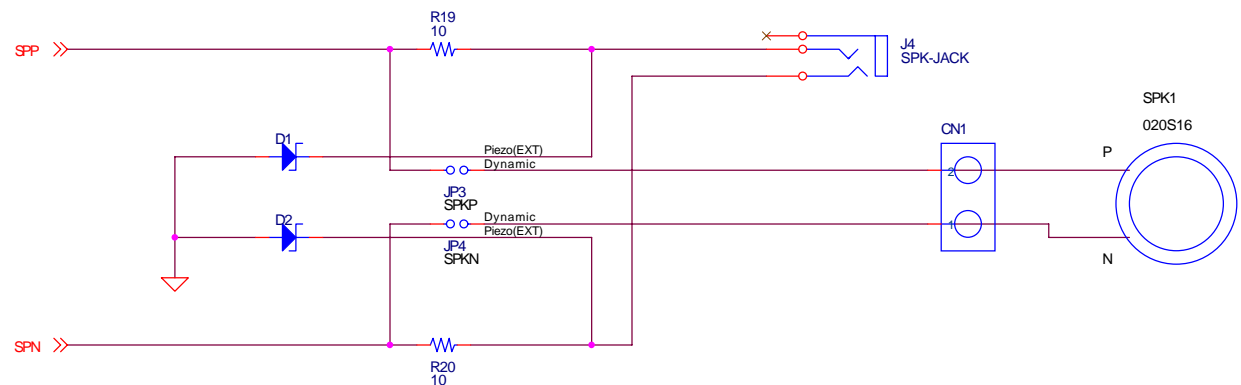
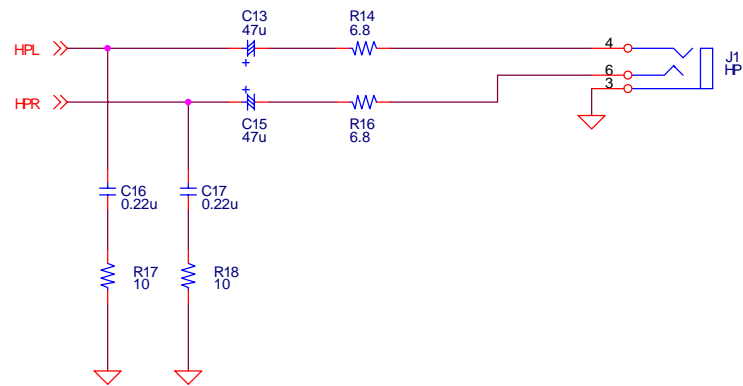
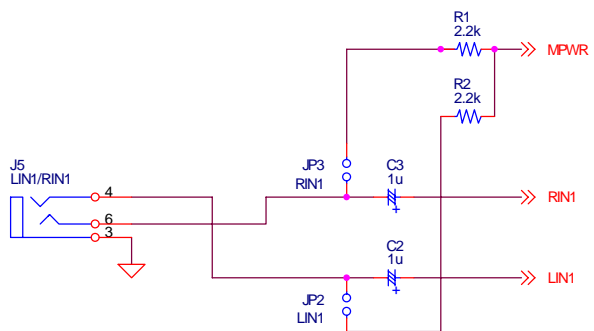
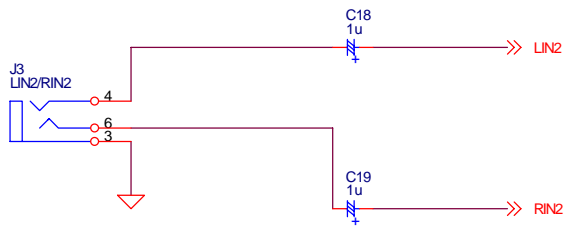
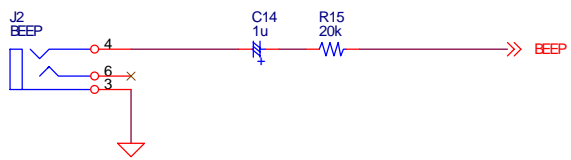
Figure 25. Crosstalk Plot



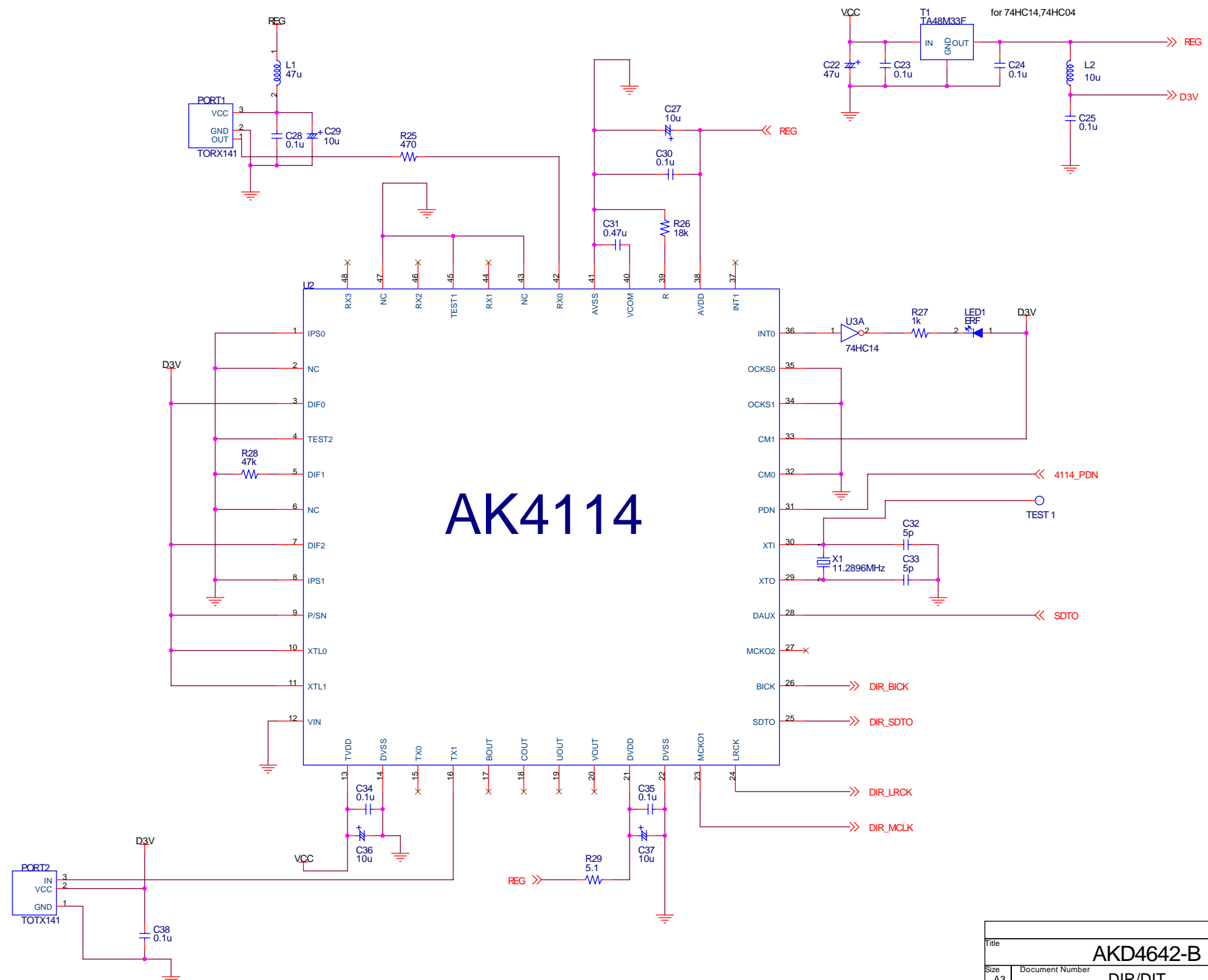
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  - (b) A critical component is one whose failure to function or perform may reasonably be expected to result, whether directly or indirectly, in the loss of the safety or effectiveness of the device or system containing it, and which must therefore meet very high standards of performance and reliability.
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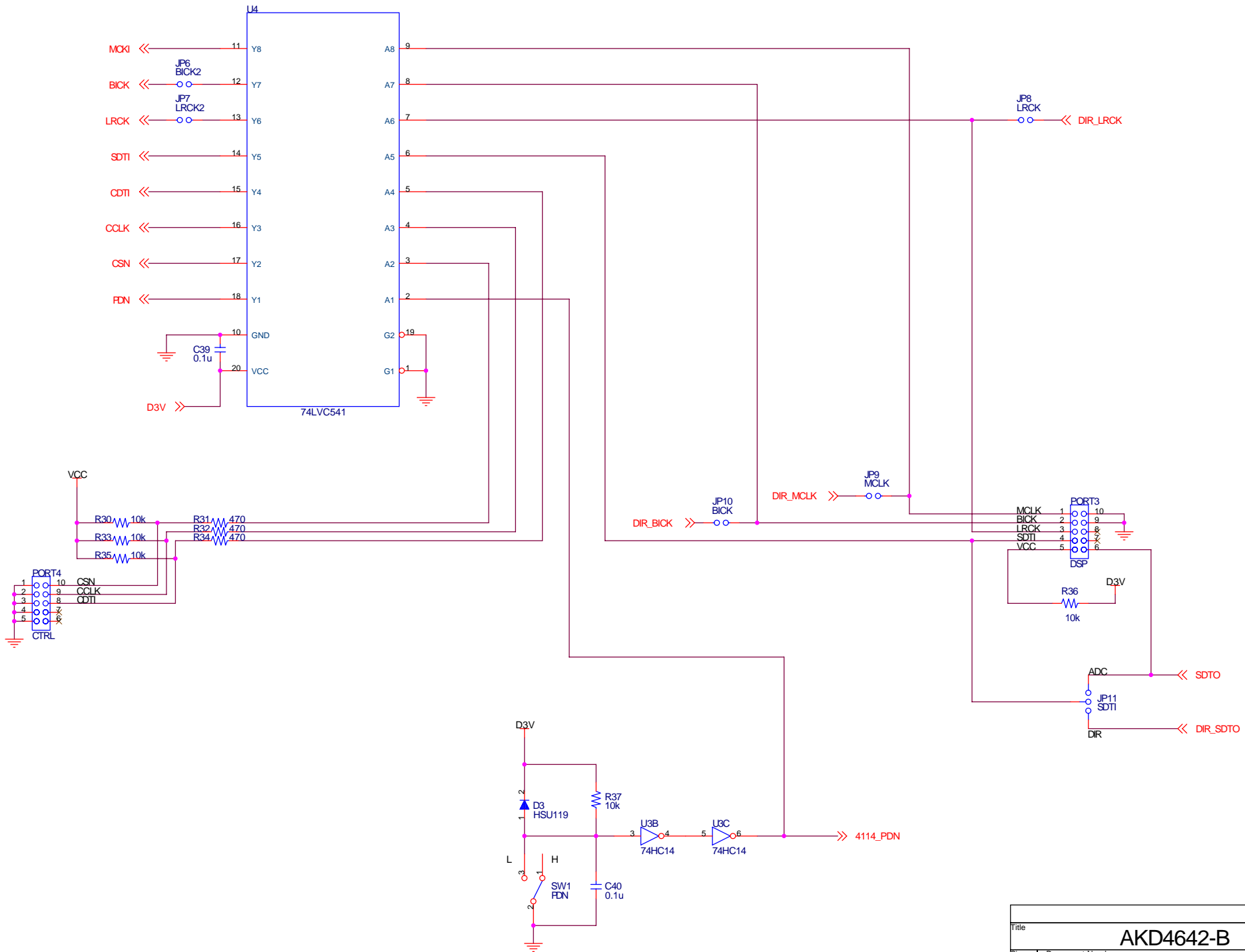


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Size	Document Number	Input/Output			Rev
A3					0
Date: Thursday, September 16, 2004			Sheet	2	of 5

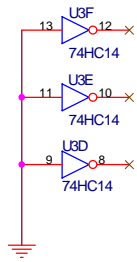


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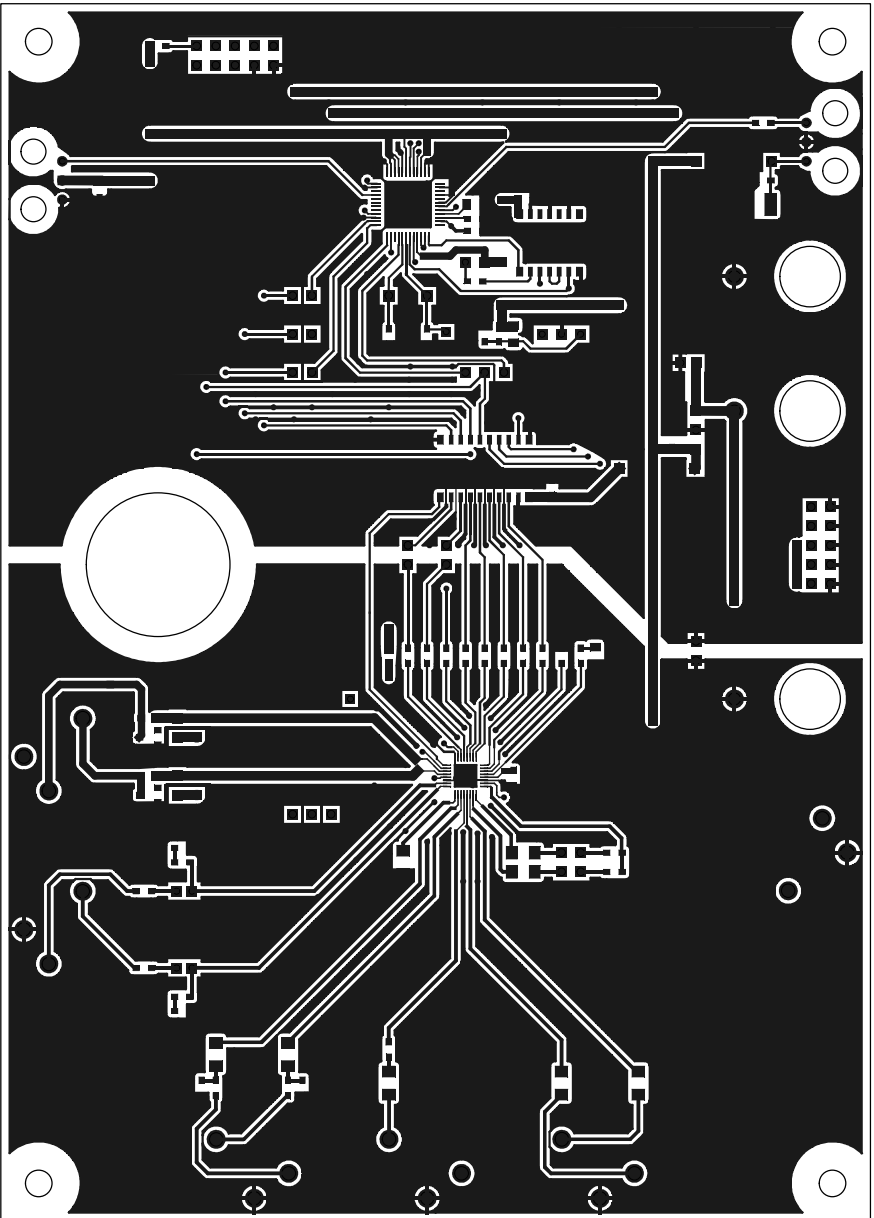
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Size	Document Number	DIR/DIT	
A3			Rev 0
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Title			AKD4642-B		
Size	Document Number	LOGIC			Rev
A3					0
Date:	Monday, September 13, 2004	Sheet	4	of	5

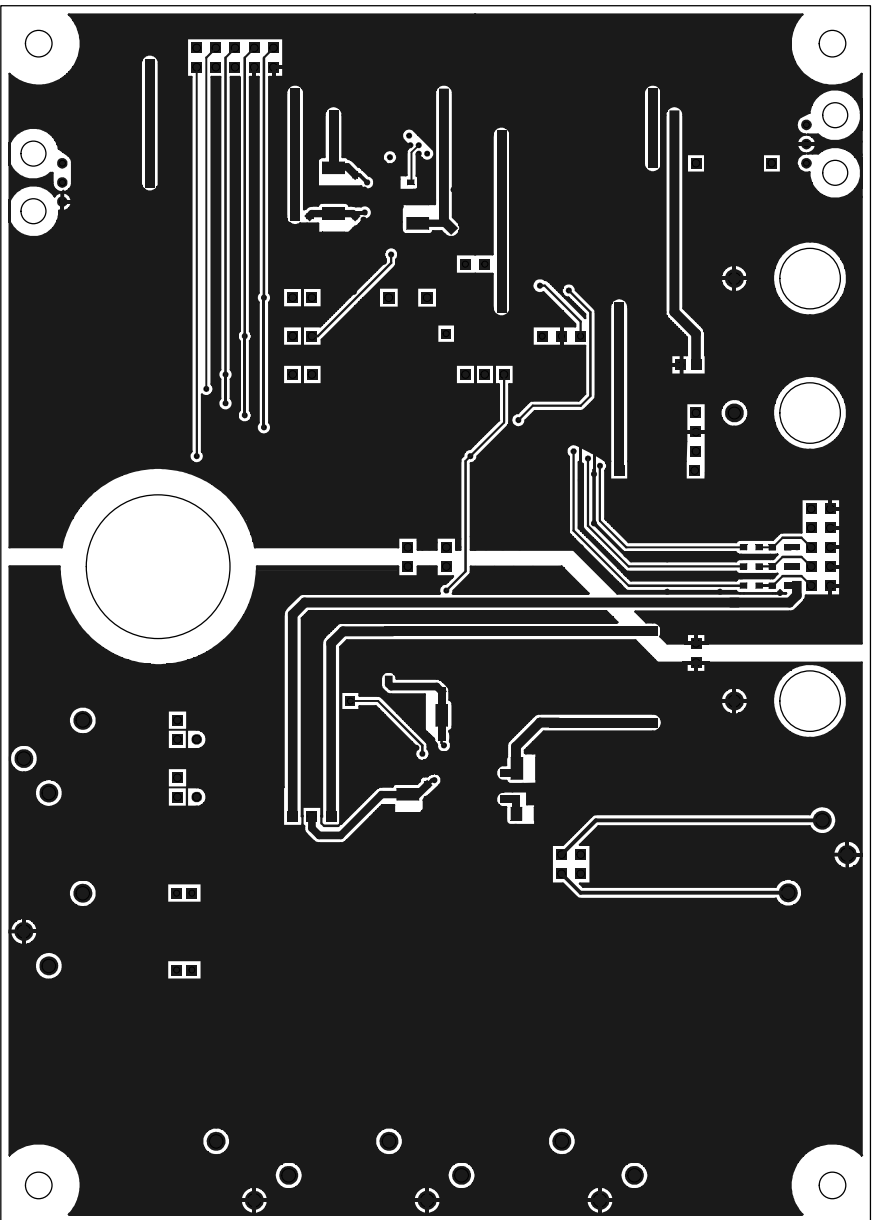


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AKD4642-B		
Size	Document Number	Rev
A3	PIN	0
Date: Thursday, September 16, 2004 Sheet 5 of 5		



部品面Aダミー

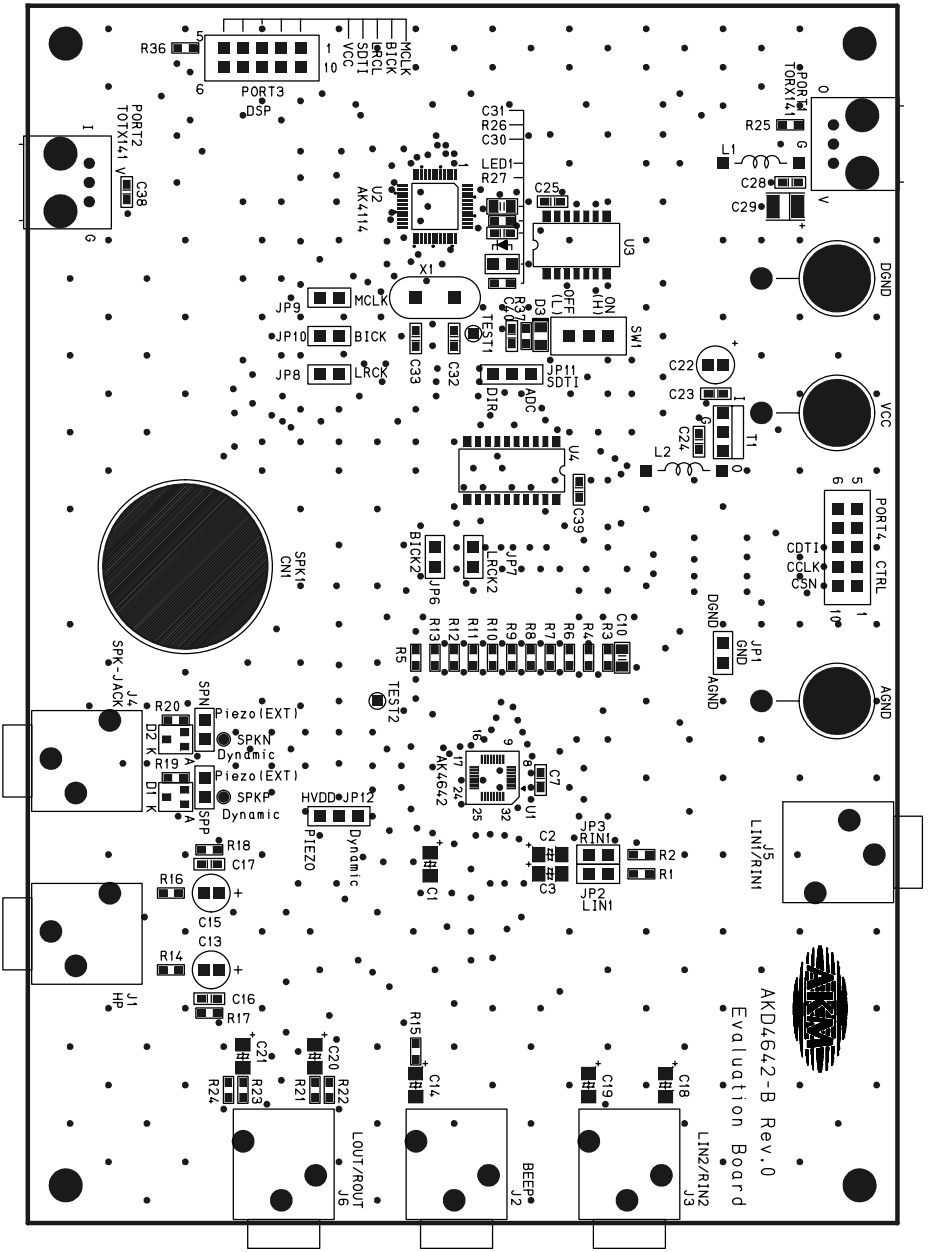
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部品面シルク 板面シルクス

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Evaluation Board



LIN2/RIN2  
J3

BEEP  
J2

LOUT/ROUT  
J6

J1  
HP

J4  
SPK-JACK

J5  
LIN1/RIN1

J6  
SPK-CNT

J7  
SPK

J8  
LCK

J9  
MCLK

J10  
BICK

J11  
SDTI

J12  
AOC

J13  
DIR

J14  
LCK2

J15  
BICK2

J16  
LCK2

J17  
BICK2

J18  
LCK2

J19  
BICK2

J20  
LCK2

J21  
BICK2

J22  
LCK2

J23  
BICK2

J24  
LCK2

J25  
BICK2

J26  
LCK2

J27  
BICK2

