AKD4646-B
AK4646 Evaluation board Rev.1

GENERAL DESCRIPTION

AKD4646-B is an evaluation board for the AK4646, Stereo CODEC with built-in MIC/SPK amplifier. The AKD4646-B can evaluate A/D converter and D/A converter separately in addition to loop-back mode (A/D → D/A). The AKD4646-B also has the digital audio interface and can achieve the interface with digital audio systems via opt-connector.

■ **Ordering guide**

AKD4646-B --- Evaluation board for AK4646
(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**
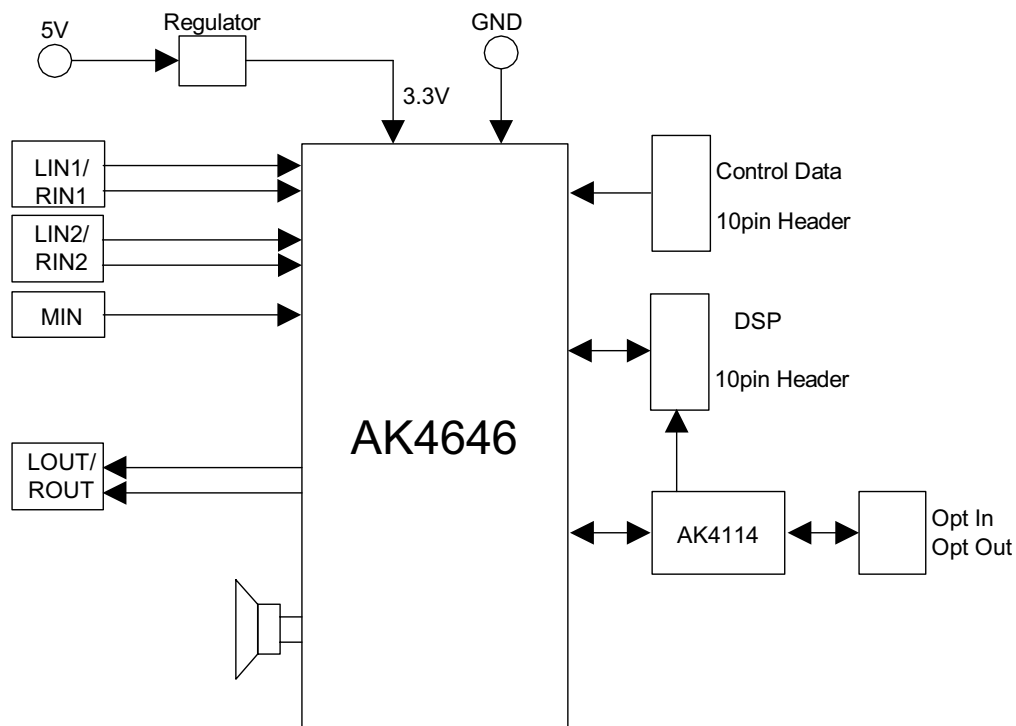- **10pin Header for serial control mode**

Figure 1. AKD4646-B Block Diagram

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

Evaluation Board Manual

■ **Operation sequence**

1) Set up the power supply lines.
   [VCC]   (red)   = 5.0V (or 3.3V)
   [AGND] (black)   = 0V
   [DGND] (black)   = 0V

   Each supply line should be distributed from the power supply unit.
   When the power is supplied to the AK4646 via the regulator, JP21 should be set to "REG" side and VCC should be 5.0V.<default> (When the power is supplied from VCC jack to the AK4646 directly, JP21 should be set to "VCC" side and VCC should be 3.3V.)

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

3) Power on.
   The AK4646 and AK4114 should be reset once bringing SW1 "L" upon power-up.
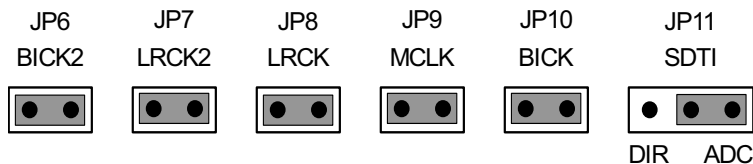
■ **Evaluation mode**

(1) Slave mode

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

**The AK4114's audio interface format is fixed to LSB Justified.**

(1-1) Evaluation of Recording block 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).

JP6	JP7	JP8	JP9	JP10	JP11
BICK2	LRCK2	LRCK	MCLK	BICK	SDTI

DIR   ADC

(1-2) Evaluation of Playback block using DIR of AK4114
   PORT1 (DIR) is used. Nothing should be connected to PORT3 (DSP).
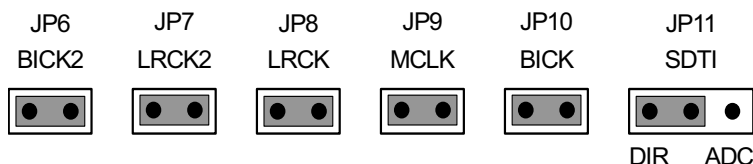
JP6	JP7	JP8	JP9	JP10	JP11
BICK2	LRCK2	LRCK	MCLK	BICK	SDTI

DIR   ADC

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.
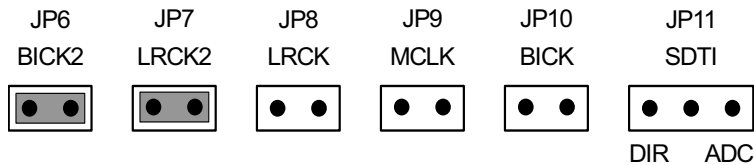
(1-3) Evaluation of Loop-back using AK4114 <Default>

X'tal oscillator (X1) is used. Nothing should be connected to PORT1 (DIR) and PORT3 (DSP).
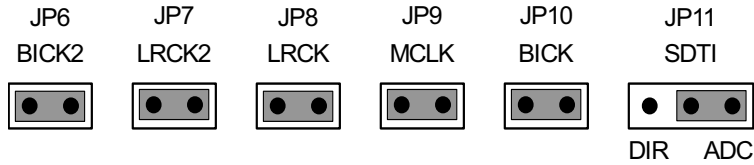
JP6	JP7	JP8	JP9	JP10	JP11
BICK2	LRCK2	LRCK	MCLK	BICK	SDTI

DIR   ADC

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.

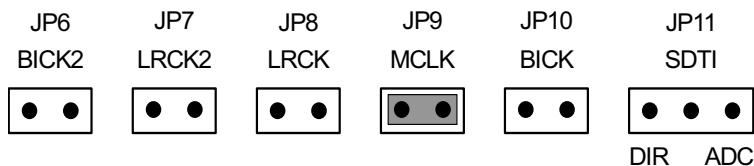PORT3 (DSP) is used. Nothing should be connected to PORT1 (DIR).

JP6	JP7	JP8	JP9	JP10	JP11
BICK2	LRCK2	LRCK	MCLK	BICK	SDTI

DIR   ADC

(2) Master mode

(2-1) Evaluation of Loop-back 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 AK4646's PLL.

JP6	JP7	JP8	JP9	JP10	JP11
BICK2	LRCK2	LRCK	MCLK	BICK	SDTI

DIR   ADC

(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 AK4646's PLL.

JP6	JP7	JP8	JP9	JP10	JP11
BICK2	LRCK2	LRCK	MCLK	BICK	SDTI

DIR   ADC
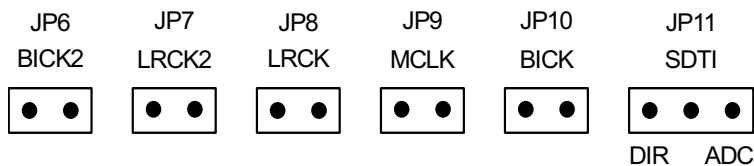
■ Other jumper pins set up

1. JP1 (GND) : Connection between AGND and DGND.
      OPEN : Both grounds are separated on board.
      SHORT : Both grounds are connected on board. <Default>

2. JP2,JP3 : Connection of mic power.
      OPEN: Mic power is not connected.
      SHORT : Mic power is connected. <Default>

3. JP4,JP5 : Select speaker type.
      OPEN : Piezo speaker
      SHORT : Dynamic speaker <Default>

■ The function of the toggle SW

[SW1] (PDN): Power down of AK4646 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 AK4646 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 AKD4646.
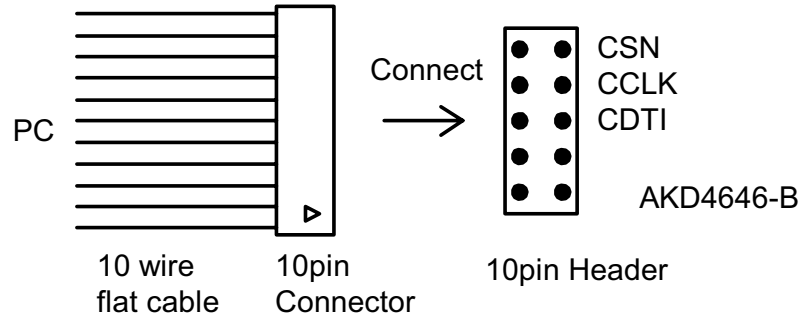
Figure 2. Connect of 10 wire flat cable

■ **Analog Input/Output Circuits**
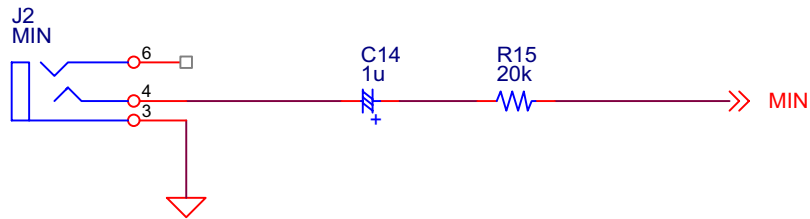
(1) Input Circuits

1. MIN Input Circuit

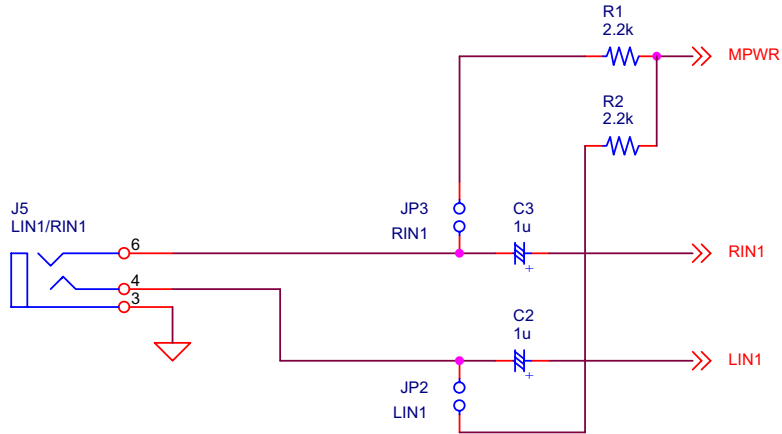Figure 3. MIN Input Circuit

2. LINE1 Input Circuit

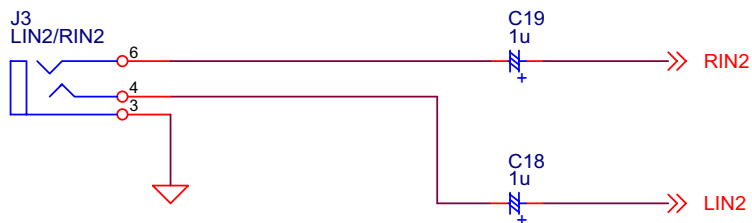Figure 4. LIN1/RIN1 Input Circuit

3. LINE2 Input Circuit

Figure 5. LIN2/RIN2 Input Circuit
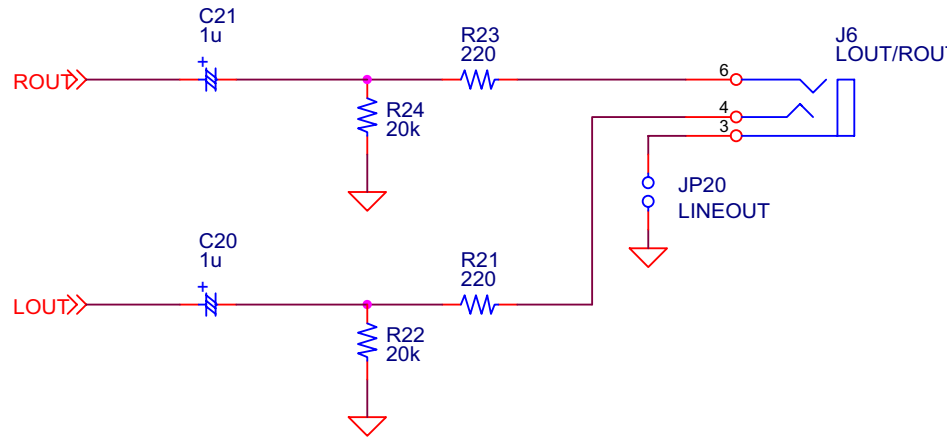
(2) Output Circuits

1.   STEREO LINE Output Circuit

Figure 6. STEREO LINE Output Circuit
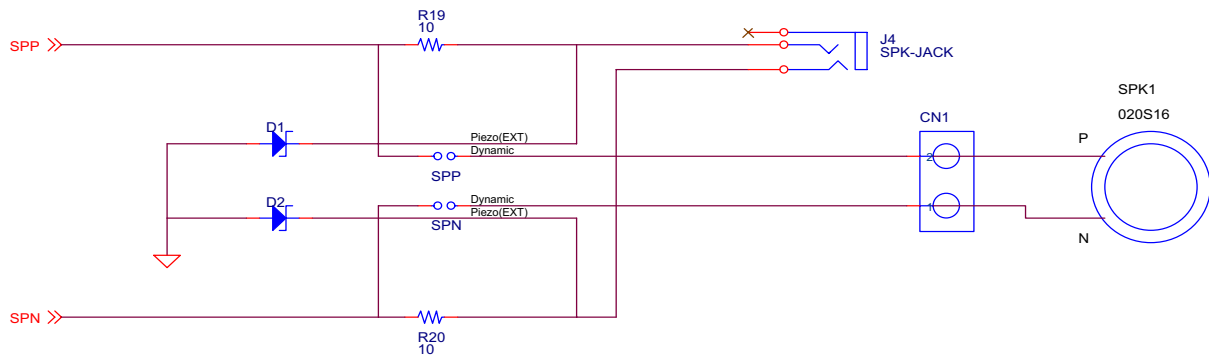
2.   SPEAKER Output Circuit

Figure 7. SPEAKER Output Circuit

Control Software Manual

■ Set-up of evaluation board and control software

1. Set up the AKD4646-B according to previous term.

2. Connect IBM-AT compatible PC with AKD4646-B by 10-line type flat cable (packed with AKD4646-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 "AKD4646-B Evaluation Kit" into the CD-ROM drive.

4. Access the CD-ROM drive and double-click the icon of "AKD4646.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.
3. Click "Write default" button

■ Explanation of each buttons

1. [Port Reset] :   Set up the port. When this is pushed, the printer port or USB port is selected automatically.
2. [Write default] :   Initialize the register of the AK4646
3. [All Write] :   Write all registers that is currently displayed
4. [Function1] :   Dialog to write data by keyboard operation.
5. [Function2] :   Dialog to evaluate IPGA and ATTL/ATTR.
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. [Write] :   Dialog to write data by mouse operation.
10. [SAVE] :   Save the current register setting.
11. [OPEN] :   Write the save values to all register.

■ 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 the AK4646, 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 the AK4646, click [OK] button. If not, click [Cancel] button.

3. **[Function2 Dialog]** : Dialog to evaluate DATT

There are dialogs corresponding to register of 09h, 0Ah, 0Ch, and 0Dh.

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 the AK4646 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 the AK4646, click [OK] button. If not, click [Cancel] button.

4. [SAVE] and [OPEN]

4-1. [SAVE]

All of current register setting values displayed on the main window are saved to the file. The extension of file name is "akr".

<Operation flow>
(1) Click [SAVE] Button.
(2) Set the file name and click [SAVE] Button. The extension of file name is "akr".

4-2. [OPEN]

The register setting values saved by [SAVE] are written to the AK4646. 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".
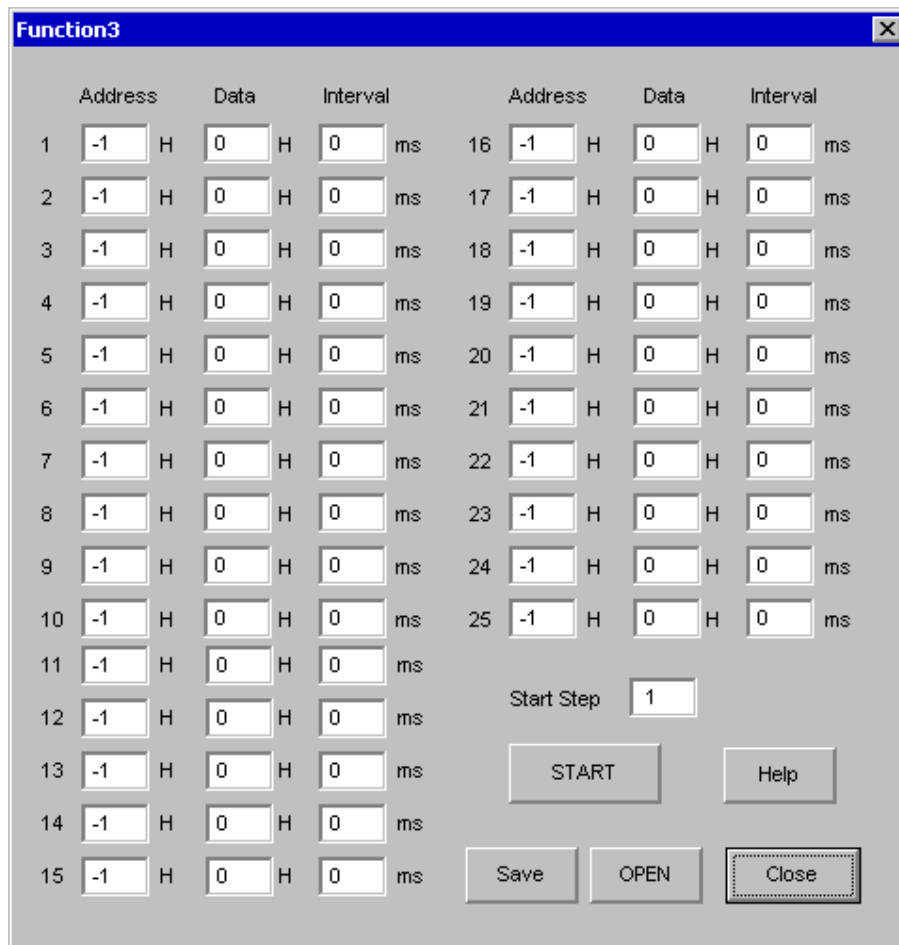

Figure 8. Window of [F3]

6. [Function4 Dialog]

The sequence file (*.aks) saved by [Function3] can be listed up to 10 files, assigned to buttons and then executed. When [F4] button is clicked, the window as shown in Figure 10 opens.
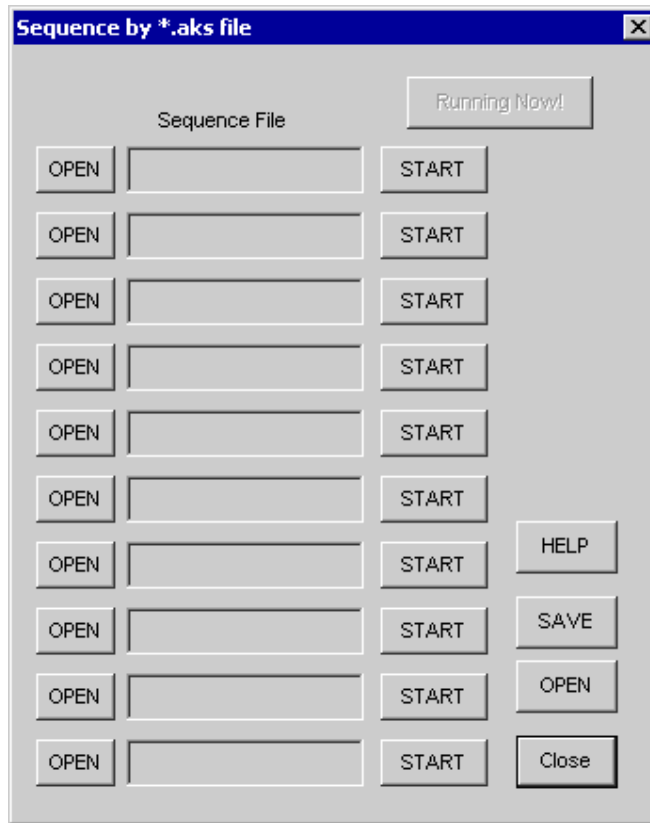
Figure 9. [F4] window

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

(1) Click [OPEN] button and select the sequence file (*.aks) saved by [Function3].

   The sequence file name is displayed as shown in Figure 11. (In case that the selected sequence file name is
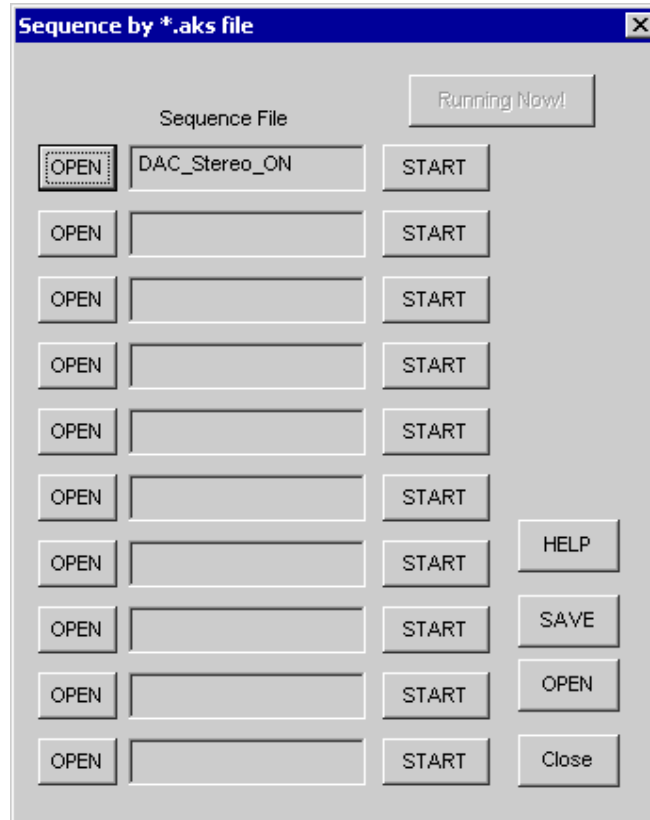   "DAC_Stereo_ON.aks")

Figure 10. [F4] window(2)

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

6-2. [SAVE] and [OPEN] buttons on right side

   [SAVE] : The name assign of sequence file displayed on [Function4] window can be saved to the file. The file name
            is "*.ak4".

   [OPEN] : The name assign of sequence file(*.ak4) saved by [SAVE] is loaded.

6-3. Note

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

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

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

7. [Function5 Dialog]

The register setting file(*.akr) saved by [SAVE] function on main window can be listed up to 10 files, assigned to buttons and then executed. When [F5] button is clicked, the window as shown in Figure 12 opens.
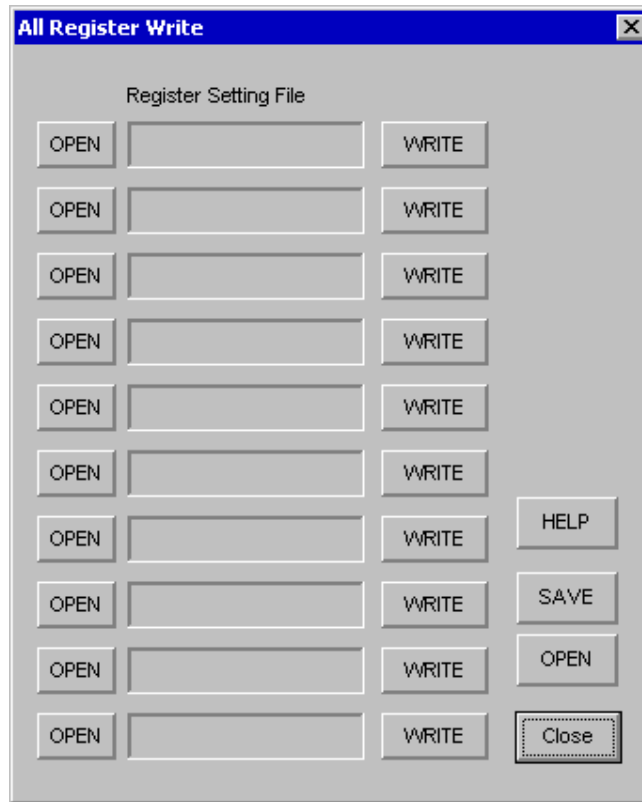
Figure 11. [F5] window

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 13. (In case that the selected file name is "DAC_Output.akr")

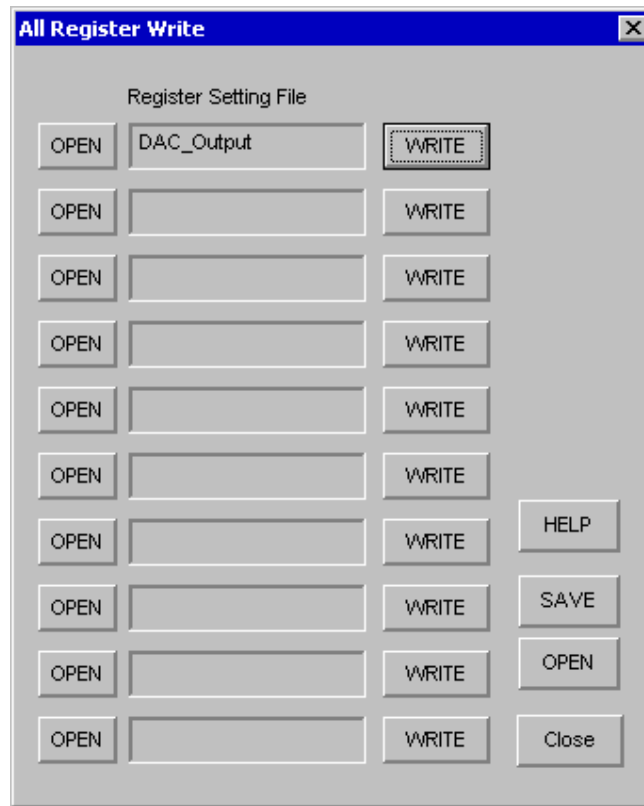(2) Click [WRITE] button, then the register setting is executed.

Figure 12. [F5] windows(2)

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

[SAVE] : The name assign of register setting file displayed on [Function5] window can be saved to the file. The file name is "*.ak5".
[OPEN] : The name assign of register setting file(*.ak5) saved by [SAVE] is loaded.

7-3. Note

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

(2) When the register setting is changed by [SAVE] Button on the main window, the register setting file (*.akr) should be loaded again in order to reflect the change.

8. [Filter Dialog]

A calculation of a coefficient of Digital Programmable Filter such as HPF,EQ filter ,a write to a register and check frequency response such as HPF,EQ filter.
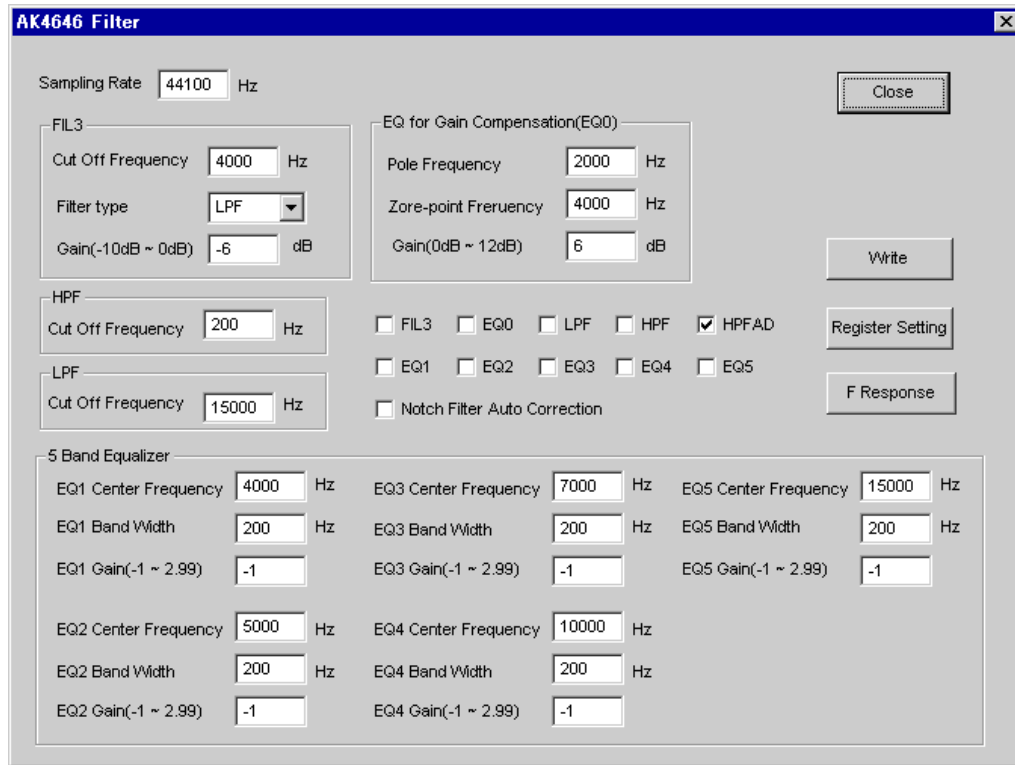Window to show to Figure 13 opens when push a [Filter] button .

Figure13. Main Window

8-1. Setting of a parameter

(1) Please set a parameter of each Filter.

Item	Contents	Setting range
Sampling Rate	Sampling frequency (fs)	$7350Hz \leq fs \leq 48000Hz$
FIL3		
Cut Off Frequency	Stereo separation emphasis filter cut cff frequency	$fs/10000 \leq$ Cut Off Frequency $\leq$ (0.497 * fs)
Filter type	Type of stereo separation emphasis filter	LPF or HPF
Gain	Gain of stereo separation emphasis filter	$-10dB \leq Gain \leq 0dB$
HPF		
Cut Off Frequency	High pass filter cut off frequency	$fs/10000 \leq$ Cut Off Frequency $\leq (0.497 * fs)$
LPF		
Cut Off Frequency	Low pass filter cut off frequency	$fs/20 \leq$ Cut Off Frequency $\leq$ (0.497 * fs)
EQ for Gain Compensation (EQ0)		
Pole Frequency	Pole Frequency	$fs/10000 \leq$ Pole Frequency $\leq$ (0.497 * fs)
Zero-point Frequency	Zero-point Frequency	$fs/10000 \leq$ Zero-point Frequency $\leq (0.497 * fs)$
Gain	Gain	$0dB \leq Gain \leq +12dB$
5 Band Equalizer		
EQ1-5 Center Frequency	EQ1-5 Center Frequency	$0Hz \leq$ Center Frequency $< (0.497 * fs)$
EQ1-5 Band Width	EQ1-5 Band Width (Note 1)	$1Hz \leq$ Band Width $< (0.497 * fs)$
EQ1-5 Gain	EQ1-5 Gain (Note 2)	$-1 \leq Gain < 3$

Note 1. A gain difference is a bandwidth of 3dB from center frequency.
Note 2. When a gain is smaller than 0 , EQ becomes a notch filter.

(2) "FIL3", "EQ0", "LPF", "HPF", "HPFAD", "EQ1", "EQ2", "EQ3", "EQ4", "EQ5" Please set ON/OFF of Filter with a check button. When checked it, Filter becomes ON. When checked "Notch Filter Auto Correction", perform automatic revision of center frequency of a notch filter. ("Cf. 8-4. automatic revision of center frequency of a notch filter")
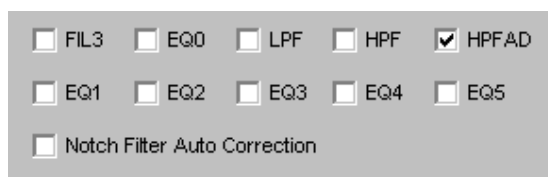
Figure14. Filter ON/OFF setting button

8-2. A calculation of a register

A register set value is displayed when push a [Register Setting] button. When a value out of a setting range is set, error message is displayed, and, a calculation of register setting is not carried out.
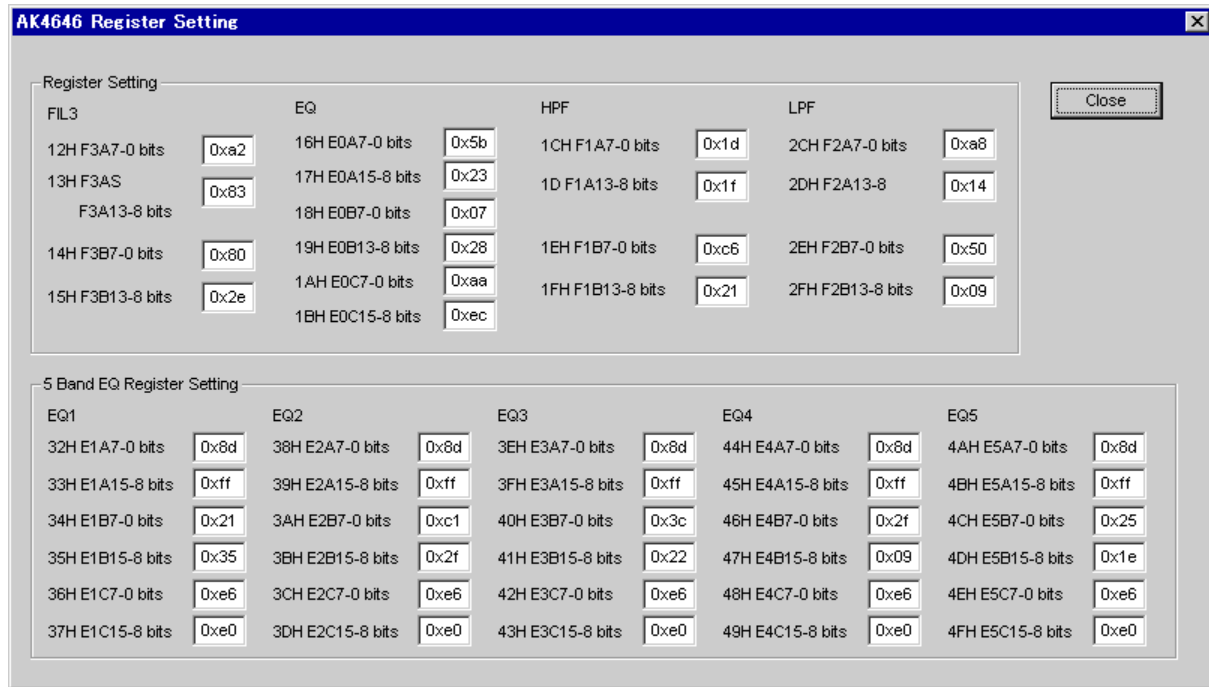

Figure15. A register setting calculation result

When it is as follows that a register set value is updated.
(1) When [Register Setting] button was pushed.
(2) When [Frequency Response] button was pushed.
(3) When [UpDate] button was pushed on a frequency characteristic indication window.
(4) When set ON/OFF of a check button "Notch Filter Auto Correction"

8-3.Indication of a frequency characteristic

A frequency characteristic is displayed when push a [Frequency Response] button. In addition, a register set point is updated then, too.
Change "Frequency Range", and indication of a frequency characteristic is updated when push a [UpDate] button.
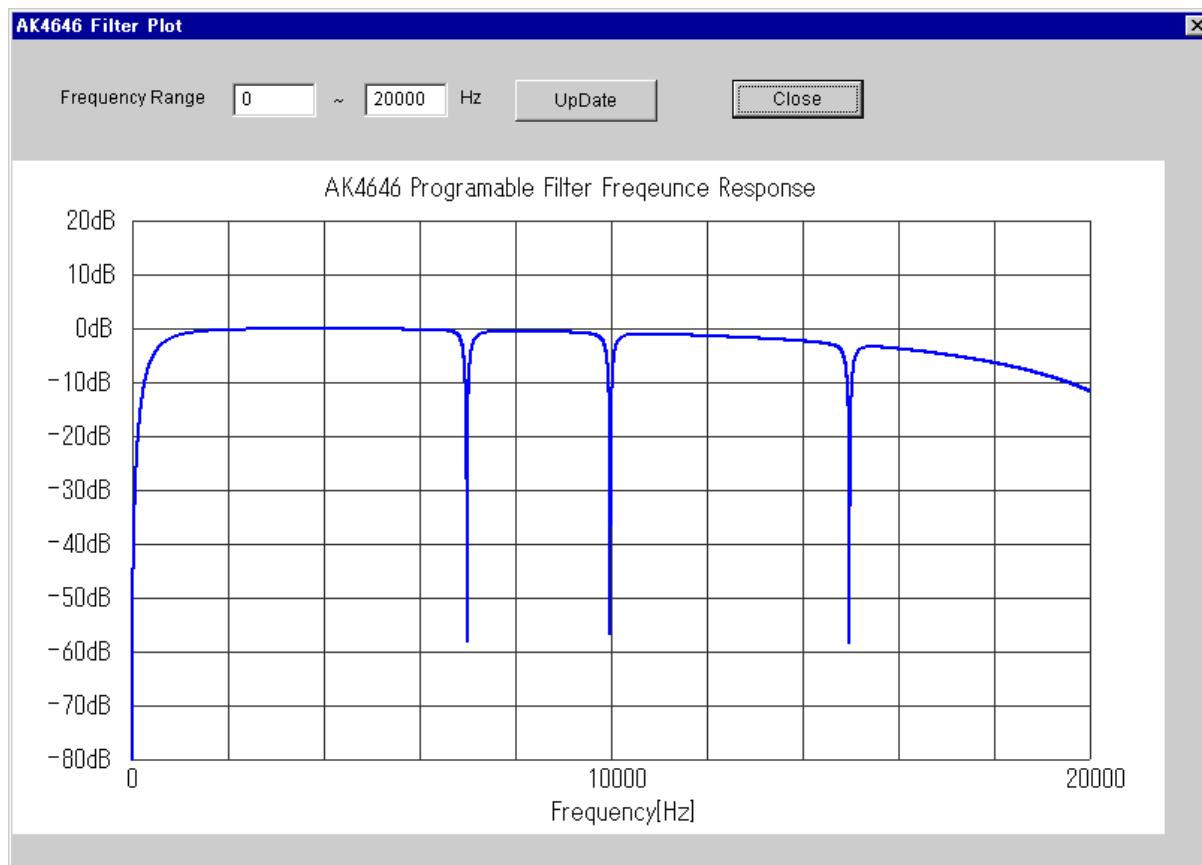

Figure16. A frequency characteristic indication result

When it is as follows that a register set point is updated.
(1) When [Register Setting] button was pushed.
(2) When [Frequency Response] button was pushed.
(3) When [UpDate] button was pushed on a frequency characteristic indication window.
(4) When set ON/OFF of a check button "Notch Filter Auto Correction"

8-4. Automatic revision of center frequency of a notch filter

When set a gain of 5 band Equalizer to -1, Equalizer becomes a notch filter. When center frequency of plural notch filters is adjacent, produce a gap to central frequency (Figure 17). When check "a Notch Filter Auto Correction" button, perform automatic revision of central frequency of a notch filter, display register setting after automatic revision and a frequency characteristic (Figure 18). This automatic revision is availability for Equalizer Band which set a gain to "-1".

(Note) When distance among center frequency is smaller than band width, there is a possibility that automatic revision is not performed definitely. Please confirm a revision result by indication of a frequency characteristic.
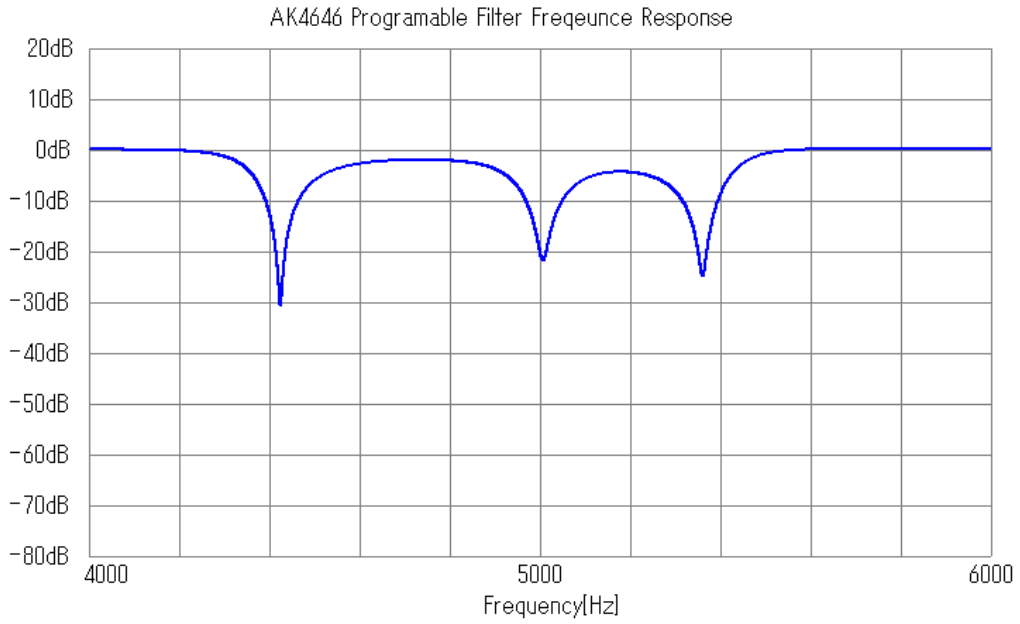
AK4646 Programable Filter Freqeunce Response

Setting of center frequency: 4400Hz, 5000Hz, 5400Hz / Band Width : 200Hz(3 band common)
Figure17. When there is no revision of center frequency

AK4646 Programable Filter Freqeunce Response

Setting of center frequency: 4400Hz, 5000Hz, 5400Hz / Band Width : 200Hz(3 band common)
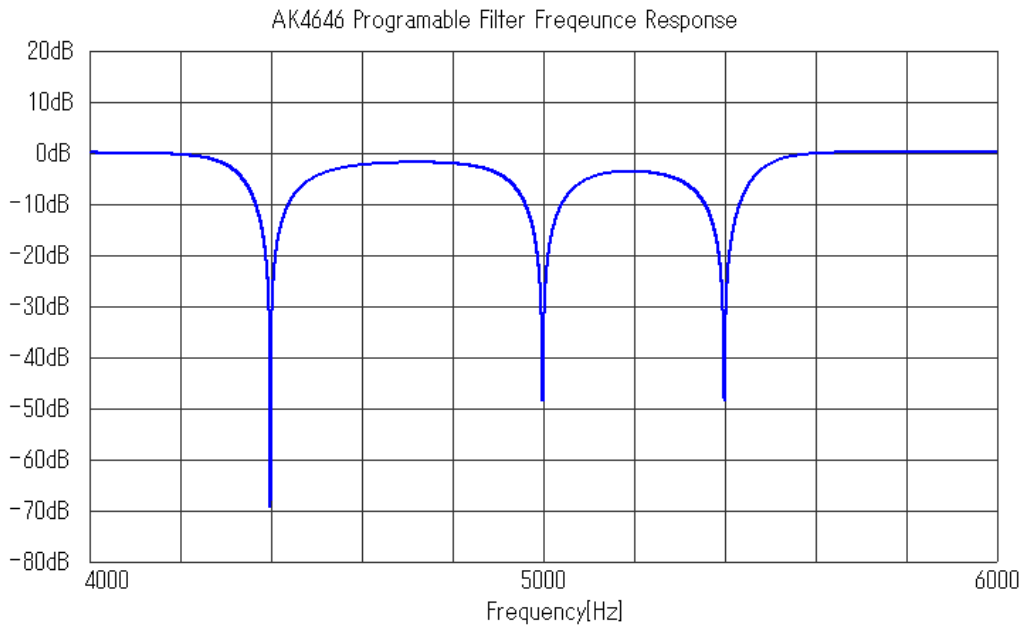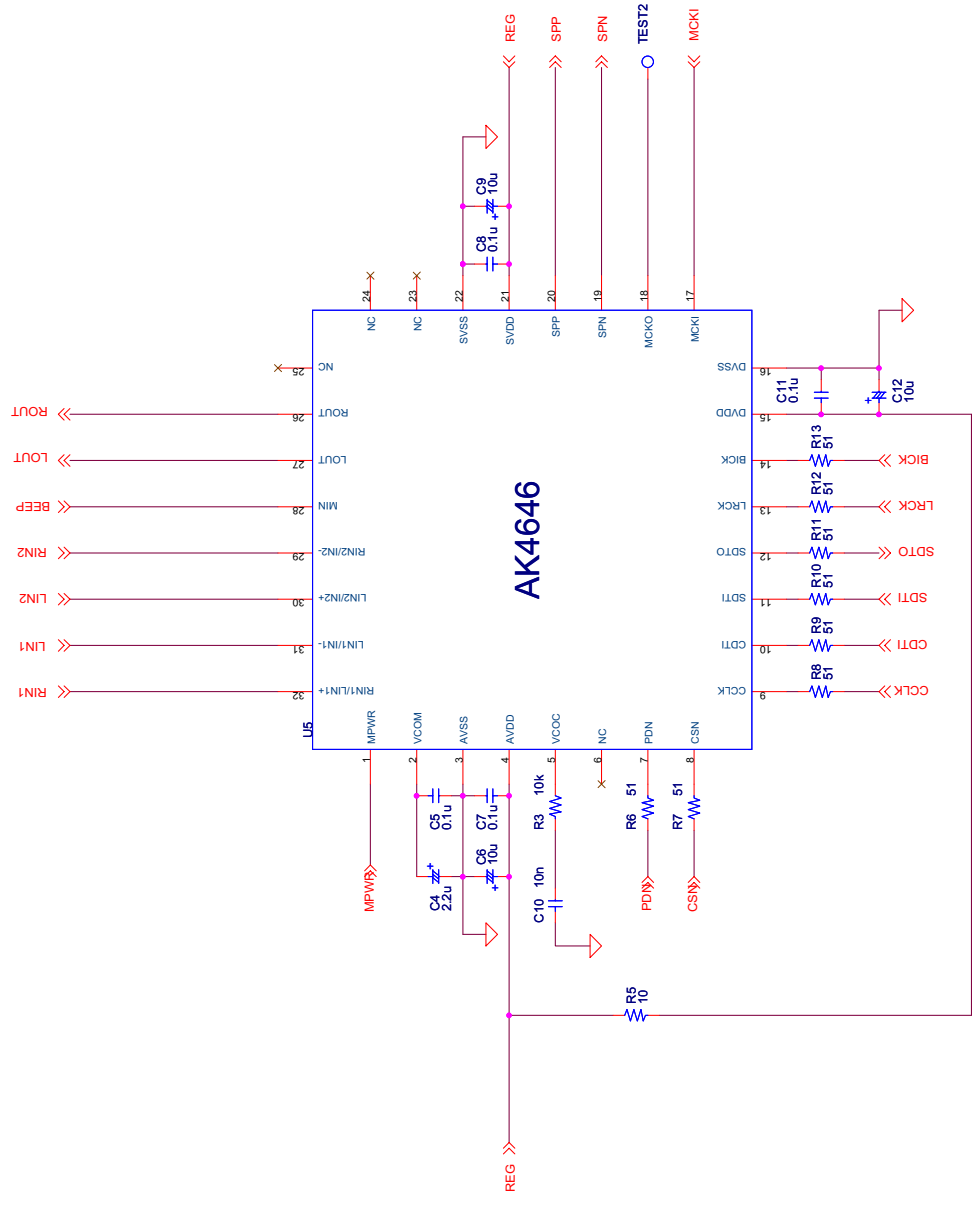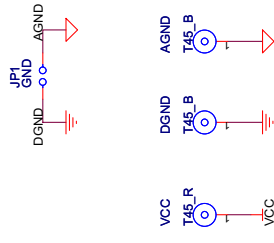Figure18. When there is revision of center frequency

Revision History

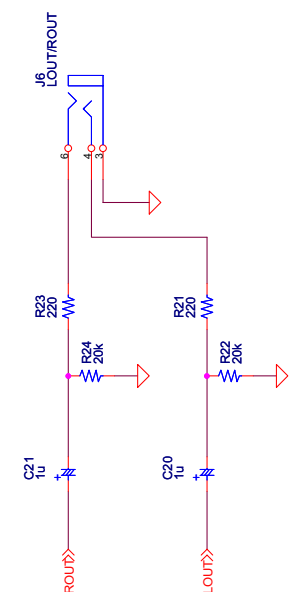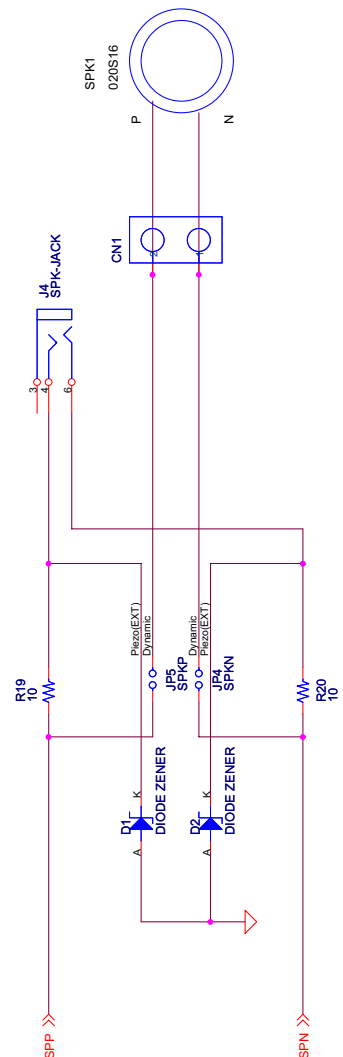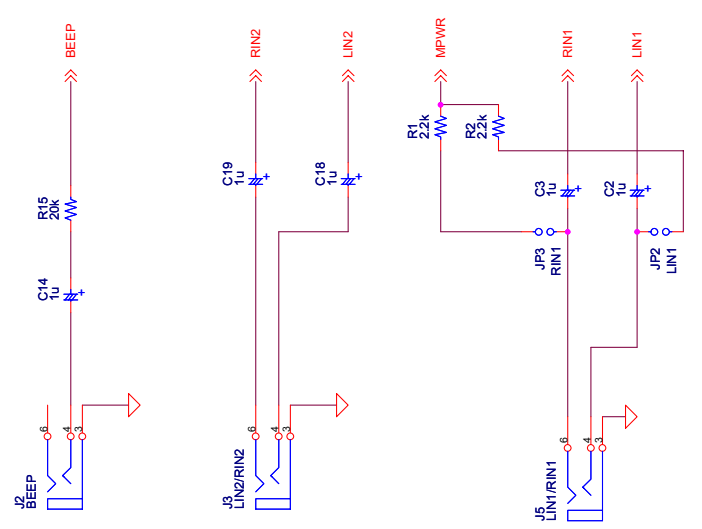| Date (YY/MM/DD)	Manual Revision	Board Revision	Reason	Contents
06/06/20	KM084100	0	First Edition	
06/08/25	KM084101	1	Parts Change	• AK4646 Rev.A → AK4646 Rev.B • C10 4.7nF → 10nF

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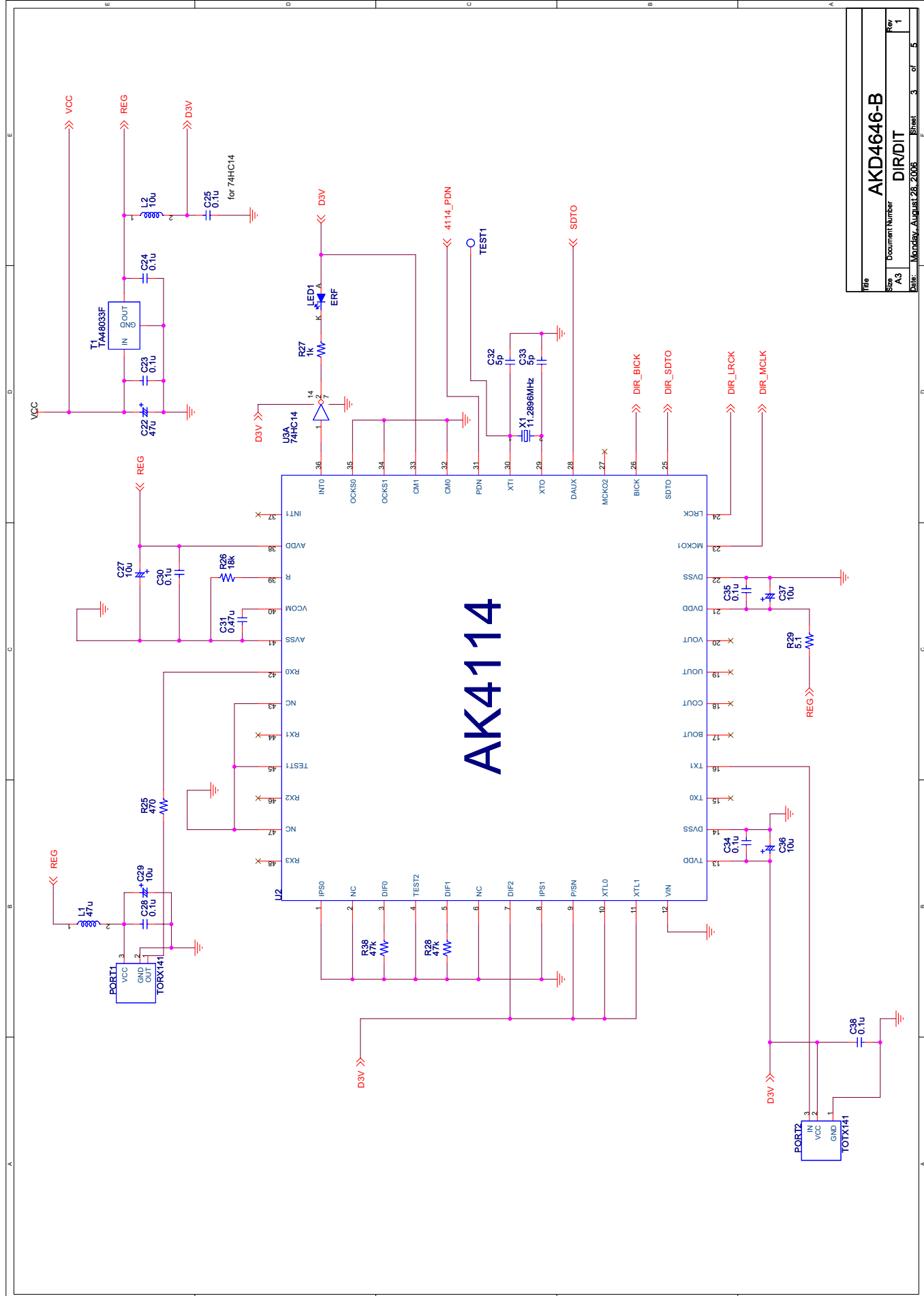
JP1
GND
DGND GND AGND

AGND
T45_B

DGND
T45_B

VCC
T45_R

VCC

U5
AK4646

24 NC
23 NC
22 SVSS
21 SVDD
20 SPP
19 SPN
18 MCKO
17 MCKI

25 NC
26 ROUT
27 LOUT
28 MIN
29 RIN2/IN2-
30 LIN2/IN2+
31 LIN1/IN1-
32 RIN1/IN1+

16 DVSS
15 DVDD
14 BICK
13 LRCK
12 SDTO
11 SDTI
10 CDTI
9 CCLK

1 MPWR
2 VCOM
3 AVSS
4 AVDD
5 VCOC
6 NC
7 PDN
8 CSN

REG
SPP
SPN
TEST2
MCKI

ROUT
LOUT
BEEP
RIN2
LIN2
LIN1
RIN1

BICK
LRCK
SDTO
SDTI
CDTI
CCLK

C8 0.1u C9 10u

C11 0.1u C12 10u

R13 51
R12 51
R11 51
R10 51
R9 51
R8 51

MPWR
C4 2.2u
C5 0.1u
C6 10u
C7 0.1u
R3 10k
C10 10n
R6 51
R7 51
PDN
CSN

R5 10

REG

SPK1
020S16

CN1

J4
SPK-JACK

J6
LOUT/ROUT

R19
10

R20
10

Piezo(EXT)
Dynamic

JP5
SPKP

JP4
SPKN

Dynamic
Piezo(EXT)

D1   DIODE ZENER

D2   DIODE ZENER

R23
220

R21
220

R24
20k

R22
20k

C21
1u

C20
1u

SPP

SPN

ROUT

LOUT

BEEP

RIN2

LIN2

MPWR

RIN1

LIN1

R15
20k

C19
1u

C18
1u

R1
2.2k

R2
2.2k

C3
1u

C2
1u

JP3
RIN1

JP2
LIN1

C14
1u

J2
BEEP

J3
LIN2/RIN2

J5
LIN1/RIN1

AK4114

AKD4646-B

LOGIC

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D3V

U3F
74HC14
13 — 12
14
7

U3E
74HC14
11 — 10
14
7

U3D
74HC14
9 — 8
14
7

AKD4642EN-B Rev.0
Evaluation Board

AKM

LIN2/RIN2 J3
BEEP J2
LOUT/ROUT J6
LIN1/RIN1 J5
AGND
VCC
DGND
CADD
AGND
DGND
GND JP1
JP14
PORT4 CTRL
CSN
SDA/CDTI
SCL/CCLK
C18
C19
C14
C22
C21
C20
R22
R21
R23
R24
R15
C17
R18
R14
C13
J1 HP
C15
R16
C16
R17
JP5 SPKP
Dynamic
PIEZO
SPKP
HVDD JP12
Piezo(EXT)
Dynamic
SPKN
Piezo(EXT)
JP4 SPKN
R20
R19
D1 K
D2 K
J4 SPK-JACK
R31
R32
JP2 LIN1
JP3 RIN1
C3
C2
C1
I2C-SEL
C7
U5
AK4642EN
JP13
R3
R4
R6
R7
R8
R9
R10
R11
R12
R13
R5
C10
TEST2
JP15 SDA
3-wire
I2C
JP7 LRCK2
JP6
BICK2
SPK1 CN1
L2
C39
C24
C23
C22
U4
T1
SW1
ON (H)
OFF (L)
JP11 SDTI
ADC
DIR
C32
C33
TEST1
LRCK JP8
BICK JP10
MCLK JP9
X1
ERR
U3
C25
R27
U2 AK4114
LED1
C29
C28
L1
R25
PORT1 TOTX141
C30
R26
C31
PORT3 DSP
MCLK
BICK
LRCK
SDTI
VCC
GND
GND
NC
NC
SDTO
R36
C38
PORT2 TOTX141

AKD4642EN-B L1 SILK

AKD749ZEN-B   L2   SILK

C4
C5
C6
C8
C9
C11
C12

R31
R32
R34
R30
R33
R35

C37
C35
C27
R29
C33
C23
R38
R28
R39