

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

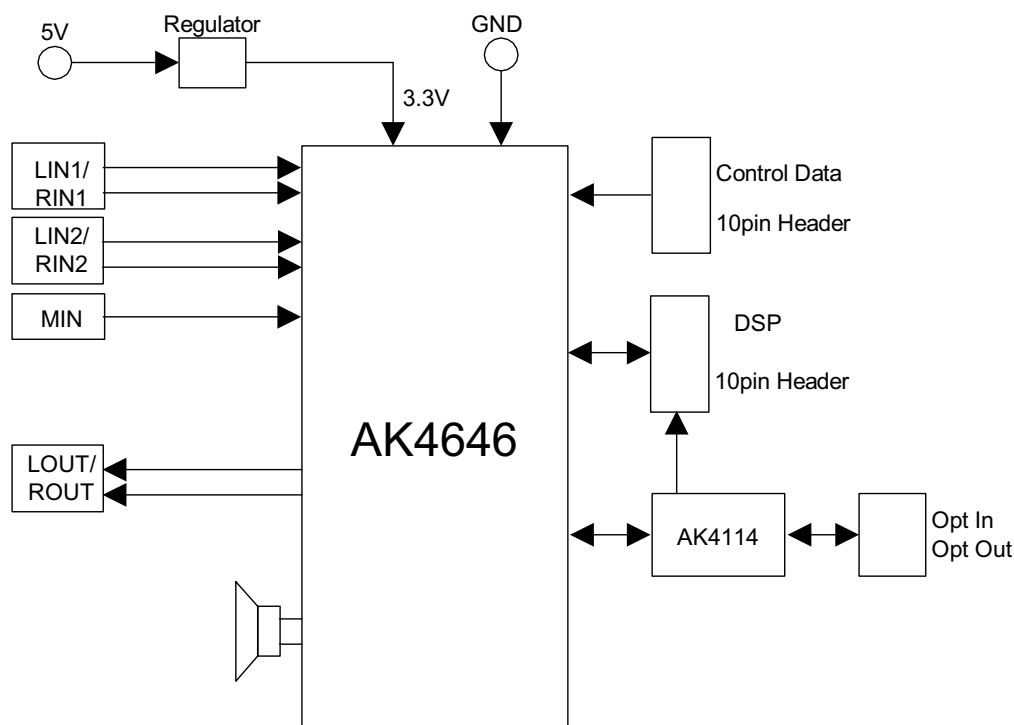


Figure 1. AKD4646-B Block Diagram

* 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

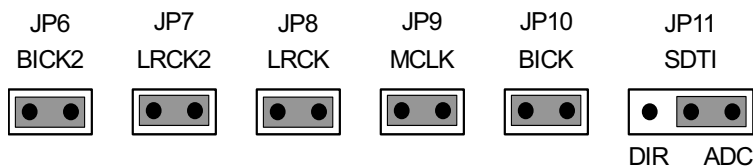
(1-3) Evaluation of Loop-back using AK4114 <Default>

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

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

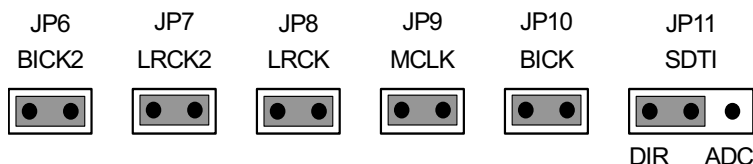
(1-1) Evaluation of Recording block using DIT of AK4114

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).



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

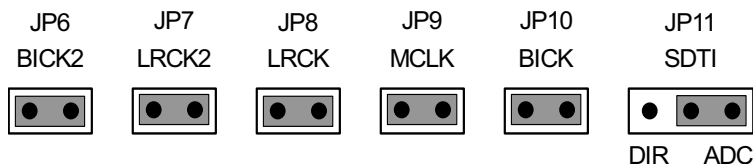
PORT1 (DIR) is used. Nothing should be connected to PORT3 (DSP).



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>

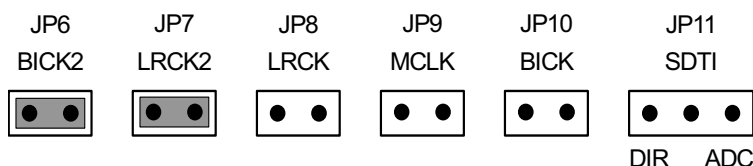
X'tal oscillator (X1) is used. Nothing should be connected to PORT1 (DIR) and PORT3 (DSP).



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).

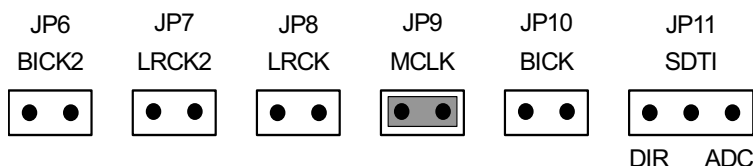
**(2) Master mode**

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

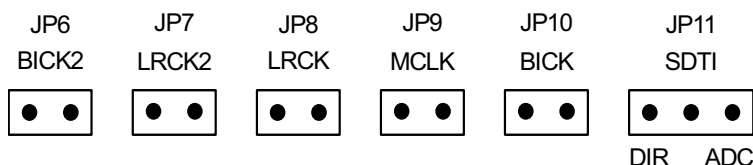
(2-2) Master clock is fed externally

(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.

**(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.



■ 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.

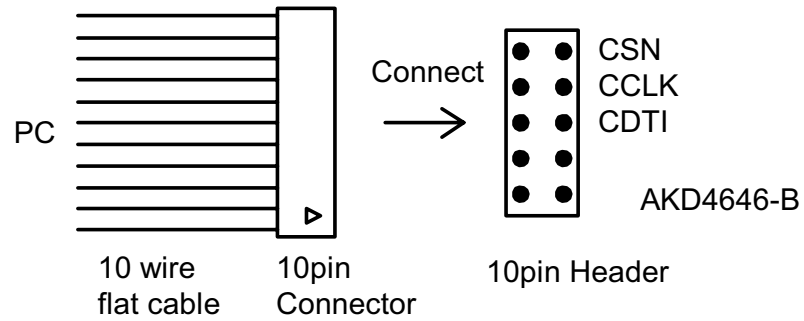


Figure 2. Connect of 10 wire flat cable

■ Analog Input/Output Circuits

(1) Input Circuits

1. MIN Input Circuit

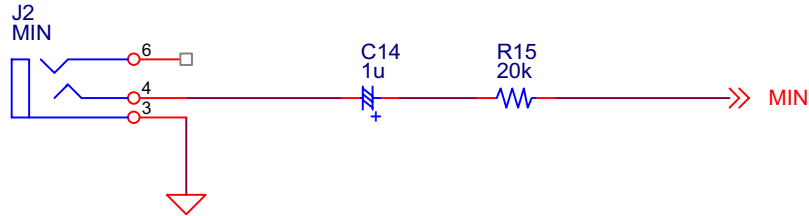


Figure 3. MIN Input Circuit

2. LINE1 Input Circuit

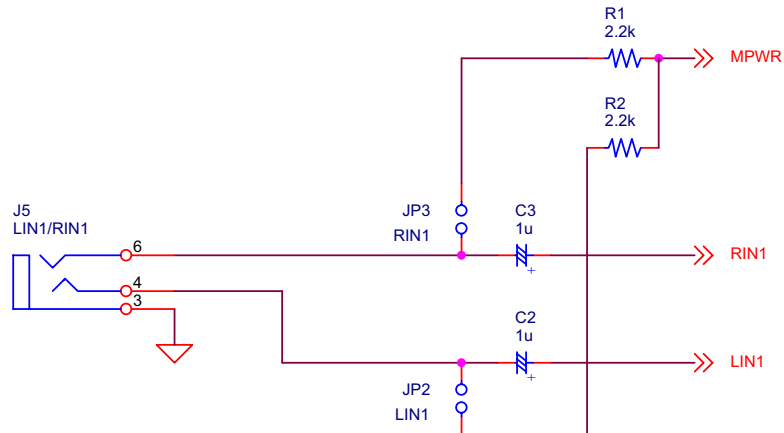


Figure 4. LIN1/RIN1 Input Circuit

3. LINE2 Input Circuit

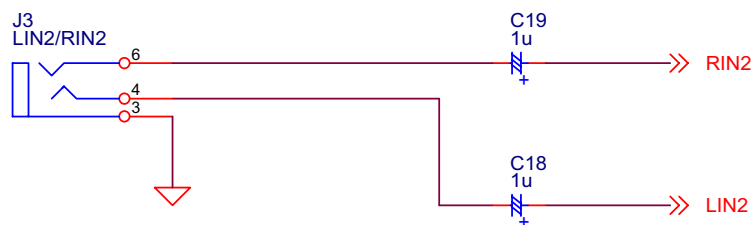


Figure 5. LIN2/RIN2 Input Circuit

(2) Output Circuits

1. STEREO LINE Output Circuit

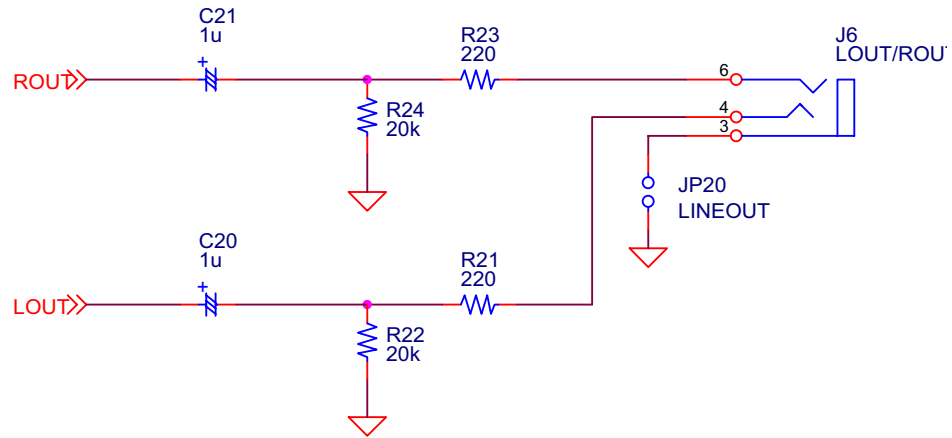


Figure 6. STEREO LINE Output Circuit

2. SPEAKER Output Circuit

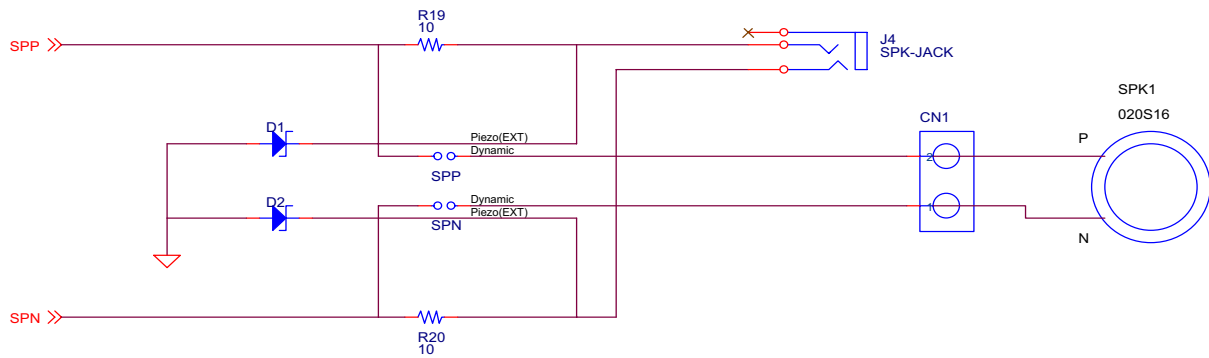


Figure 7. SPEAKER Output Circuit

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

- | | |
|--|---|
| <ol style="list-style-type: none"> 1. [Port Reset] : 2. [Write default] : 3. [All Write] : 4. [Function1] : 5. [Function2] : 6. [Function3] : 7. [Function4] : 8. [Function5] : 9.[Write] : 10.[SAVE] : 11.[OPEN] : | <p>Set up the port. When this is pushed, the printer port or USB port is selected automatically.</p> <p>Initialize the register of the AK4646</p> <p>Write all registers that is currently displayed</p> <p>Dialog to write data by keyboard operation.</p> <p>Dialog to evaluate IPGA and ATTL/ATTR.</p> <p>The sequence of register setting can be set and executed.</p> <p>The sequence that is created on [Function3] can be assigned to buttons and executed.</p> <p>The register setting that is created by [SAVE] function on main window can be assigned to buttons and executed.</p> <p>Dialog to write data by mouse operation.</p> <p>Save the current register setting.</p> <p>Write the save values to all register.</p> |
|--|---|

■ 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 “L”. If not, “0” or “1”.

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”.

	Address	Data	Interval		Address	Data	Interval
1	-1	H	0 ms	16	-1	H	0 ms
2	-1	H	0 ms	17	-1	H	0 ms
3	-1	H	0 ms	18	-1	H	0 ms
4	-1	H	0 ms	19	-1	H	0 ms
5	-1	H	0 ms	20	-1	H	0 ms
6	-1	H	0 ms	21	-1	H	0 ms
7	-1	H	0 ms	22	-1	H	0 ms
8	-1	H	0 ms	23	-1	H	0 ms
9	-1	H	0 ms	24	-1	H	0 ms
10	-1	H	0 ms	25	-1	H	0 ms
11	-1	H	0 ms				
12	-1	H	0 ms				
13	-1	H	0 ms				
14	-1	H	0 ms				
15	-1	H	0 ms				

Start Step: 1

Buttons: START, Help, Save, OPEN, Close

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.

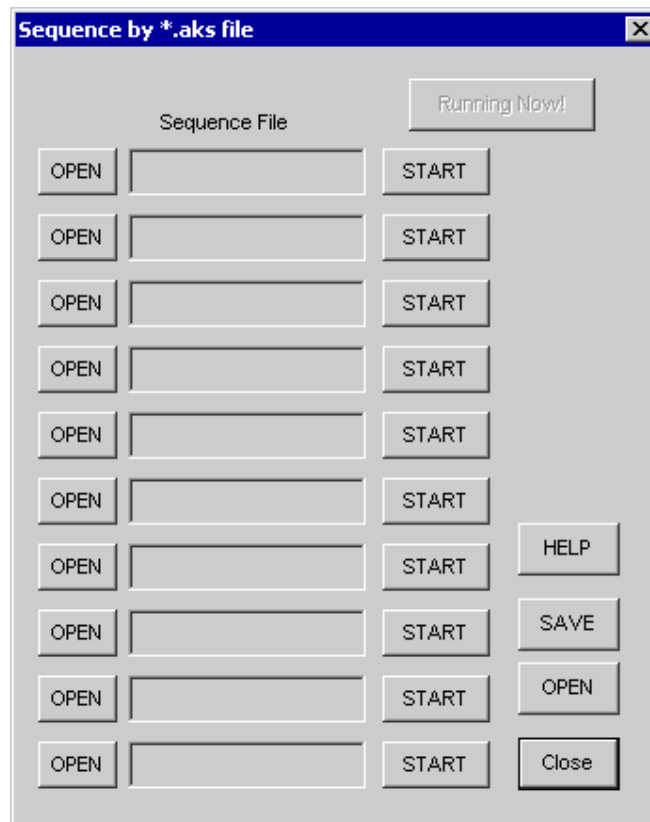


Figure 9. [F4] window

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")

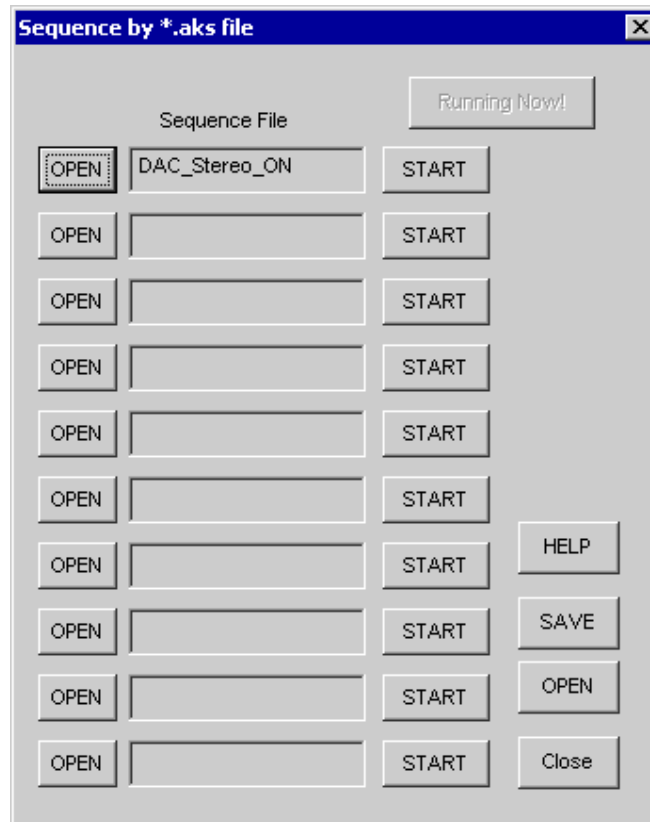


Figure 10. [F4] window(2)

(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.

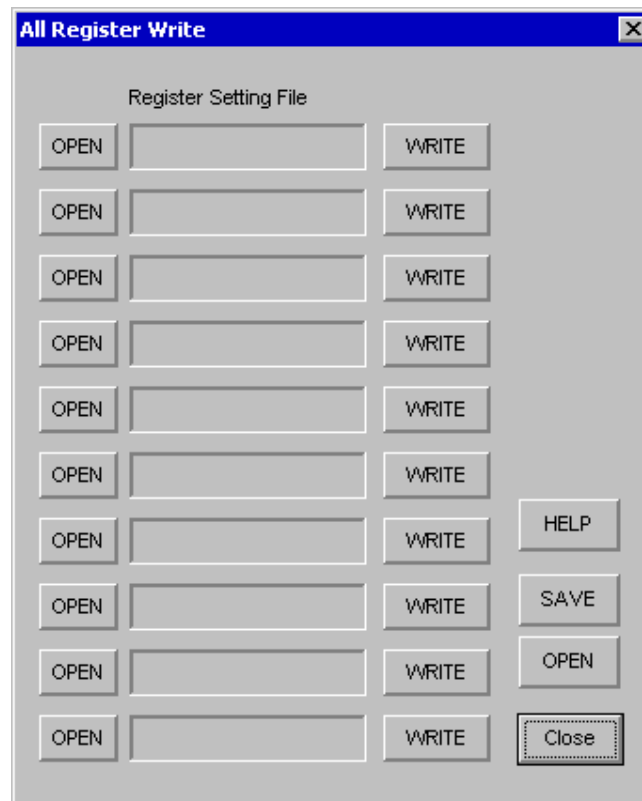


Figure 11. [F5] window

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.

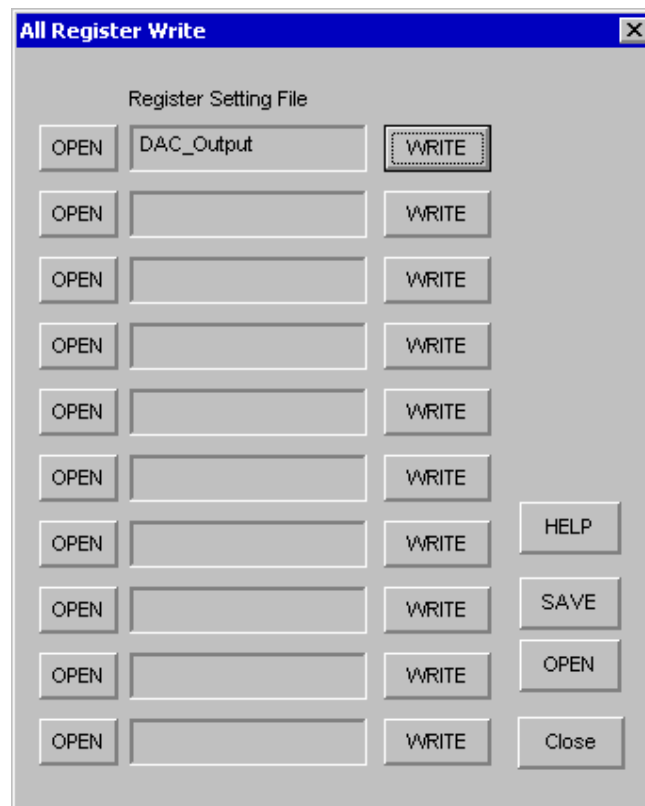


Figure 12. [F5] windows(2)

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 .

AK4646 Filter

Sampling Rate Hz

FIL3
 Cut Off Frequency Hz
 Filter type
 Gain(-10dB ~ 0dB) dB

EQ for Gain Compensation(EQ0)
 Pole Frequency Hz
 Zero-point Frequency Hz
 Gain(0dB ~ 12dB) dB

HPF
 Cut Off Frequency Hz

LPF
 Cut Off Frequency Hz

5 Band Equalizer

EQ1 Center Frequency 4000 Hz	EQ3 Center Frequency 7000 Hz	EQ5 Center Frequency 15000 Hz
EQ1 Band Width 200 Hz	EQ3 Band Width 200 Hz	EQ5 Band Width 200 Hz
EQ1 Gain(-1 ~ 2.99) -1	EQ3 Gain(-1 ~ 2.99) -1	EQ5 Gain(-1 ~ 2.99) -1
EQ2 Center Frequency 5000 Hz	EQ4 Center Frequency 10000 Hz	
EQ2 Band Width 200 Hz	EQ4 Band Width 200 Hz	
EQ2 Gain(-1 ~ 2.99) -1	EQ4 Gain(-1 ~ 2.99) -1	

☐ FIL3 ☐ EQ0 ☐ LPF ☐ HPF ☒ HPFAD
☐ EQ1 ☐ EQ2 ☐ EQ3 ☐ EQ4 ☐ EQ5
☐ Notch Filter Auto Correction

Close Write Register Setting F Response

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

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”)

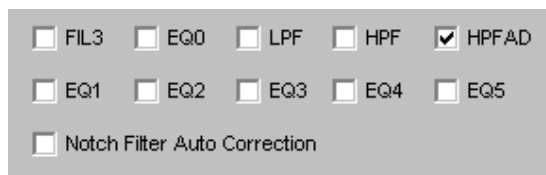


Figure14. Filter ON/OFF setting button

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.

Register Setting				
FIL3	EQ	HPF	LPF	
12H F3A7-0 bits	16H E0A7-0 bits	1CH F1A7-0 bits	2CH F2A7-0 bits	
13H F3AS	17H E0A15-8 bits	1D F1A13-8 bits	2DH F2A13-8	
F3A13-8 bits	18H E0B7-0 bits	1EH F1B7-0 bits	2EH F2B7-0 bits	
14H F3B7-0 bits	19H E0B13-8 bits	1FH F1B13-8 bits	2FH F2B13-8 bits	
15H F3B13-8 bits	1AH E0C7-0 bits			
	1BH E0C15-8 bits			

5 Band EQ Register Setting									
EQ1		EQ2		EQ3		EQ4		EQ5	
32H E1A7-0 bits	38H E2A7-0 bits	3EH E3A7-0 bits	44H E4A7-0 bits	4AH E5A7-0 bits					
33H E1A15-8 bits	39H E2A15-8 bits	3FH E3A15-8 bits	45H E4A15-8 bits	4BH E5A15-8 bits					
34H E1B7-0 bits	3AH E2B7-0 bits	40H E3B7-0 bits	46H E4B7-0 bits	4CH E5B7-0 bits					
35H E1B15-8 bits	3BH E2B15-8 bits	41H E3B15-8 bits	47H E4B15-8 bits	4DH E5B15-8 bits					
36H E1C7-0 bits	3CH E2C7-0 bits	42H E3C7-0 bits	48H E4C7-0 bits	4EH E5C7-0 bits					
37H E1C15-8 bits	3DH E2C15-8 bits	43H E3C15-8 bits	49H E4C15-8 bits	4FH E5C15-8 bits					

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.

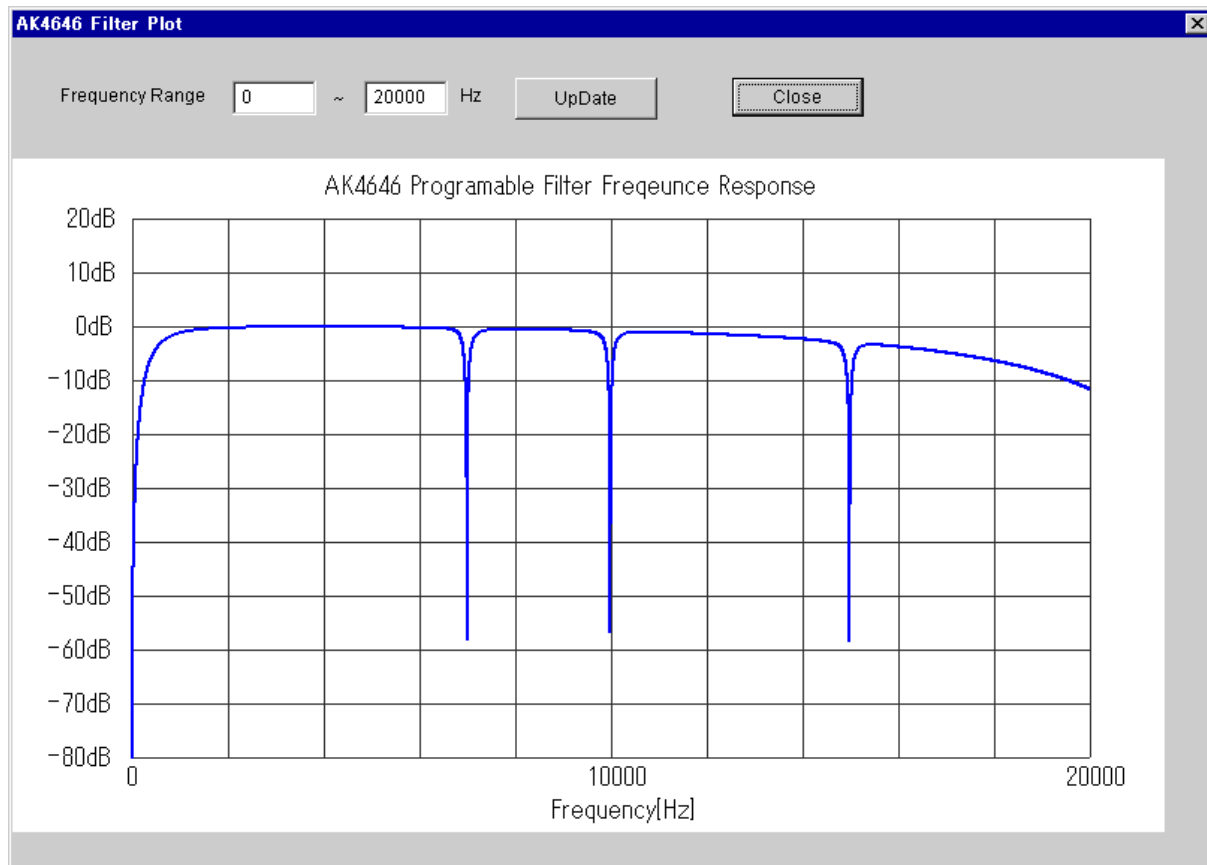


Figure16. A frequency characteristic indication result

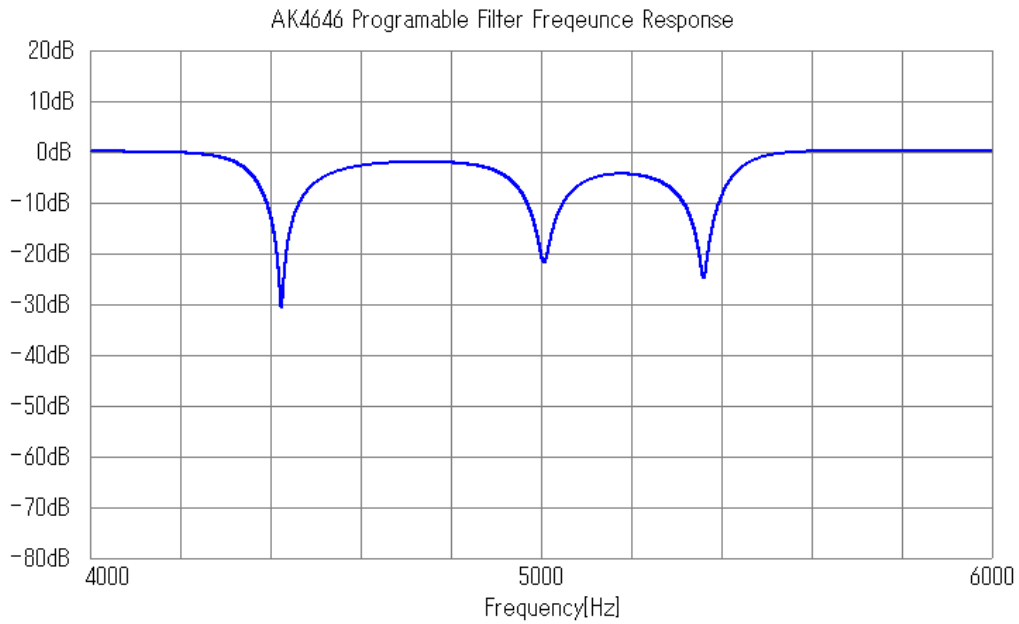
When it is as follows that a register set point is updated.

- (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

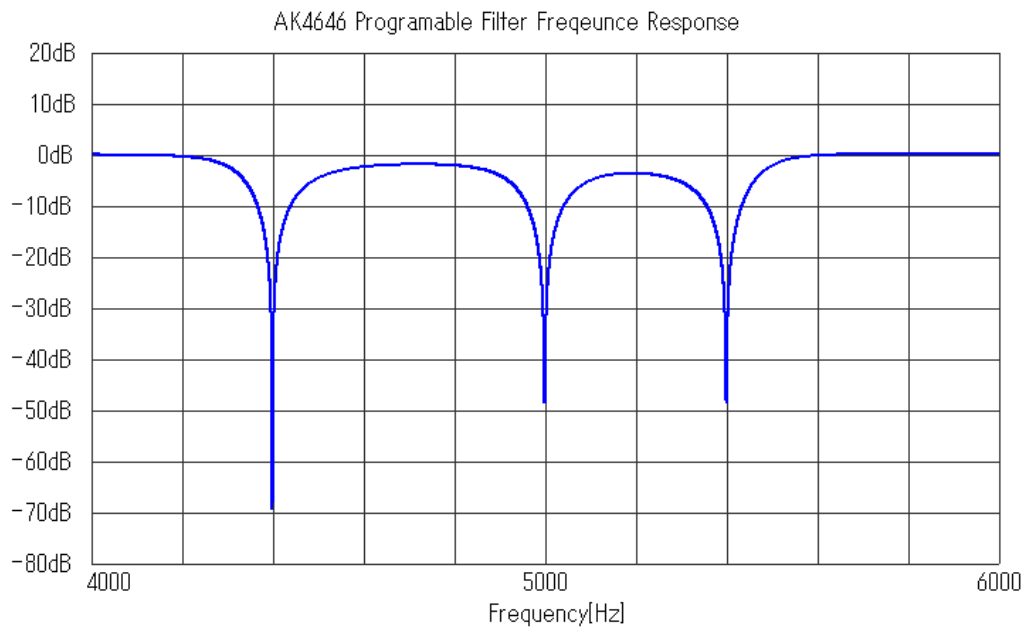
When set a gain of 5 band Equalizer to -1, Equalizer becomes a notch filter. When center frequency of plural notch filters is adjacent, produce a gap to central frequency (Figure 17). When check "a Notch Filter Auto Correction" button, perform automatic revision of central frequency of a notch filter, 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.



Setting of center frequency: 4400Hz, 5000Hz, 5400Hz / Band Width : 200Hz(3 band common)

Figure17. When there is no revision of center frequency



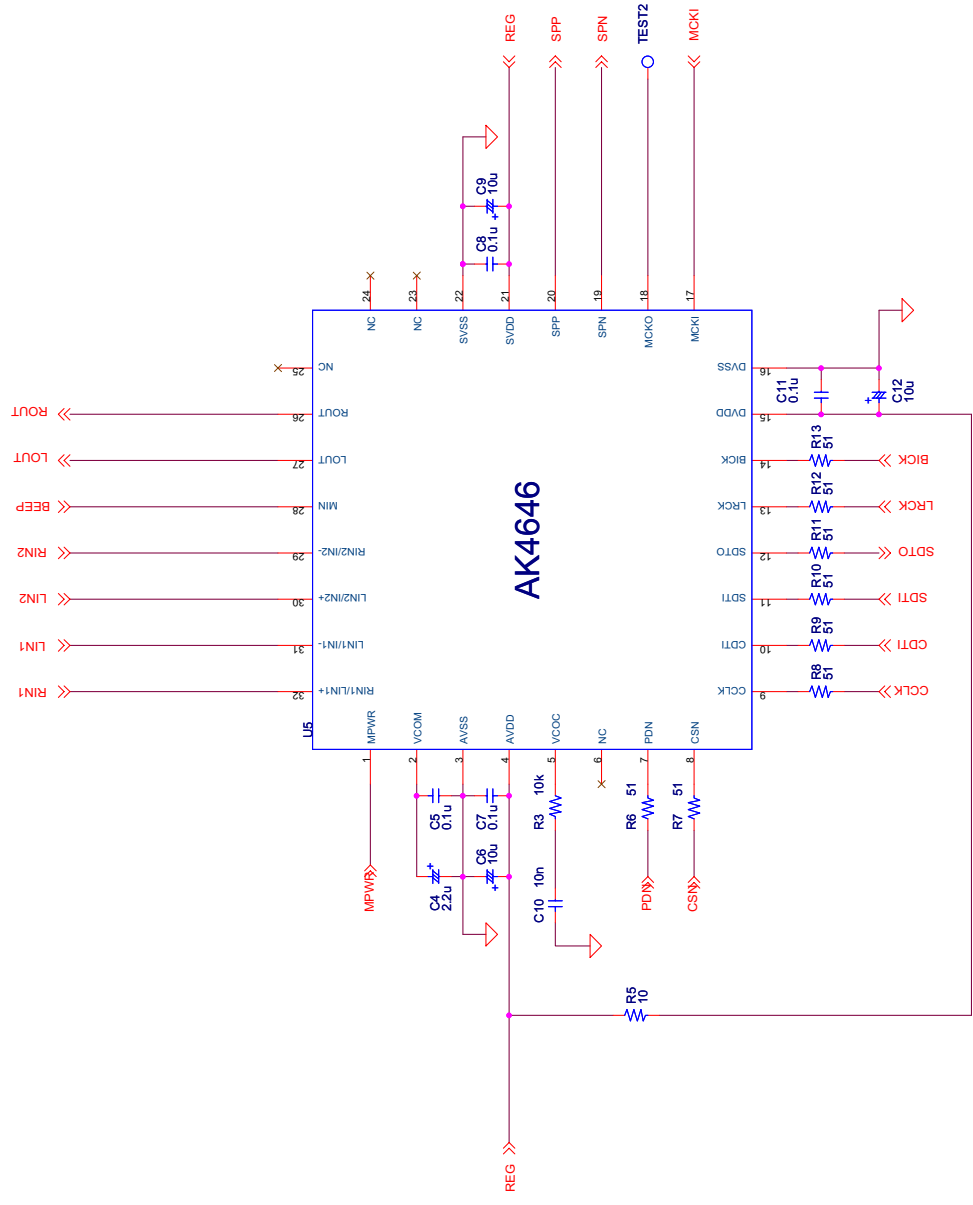
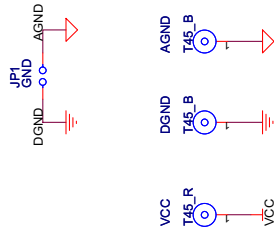
Setting of center frequency: 4400Hz, 5000Hz, 5400Hz / Band Width : 200Hz(3 band common)

Figure18. When there is revision of center frequency

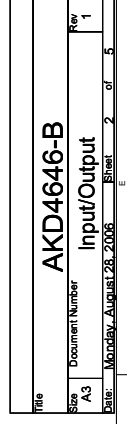
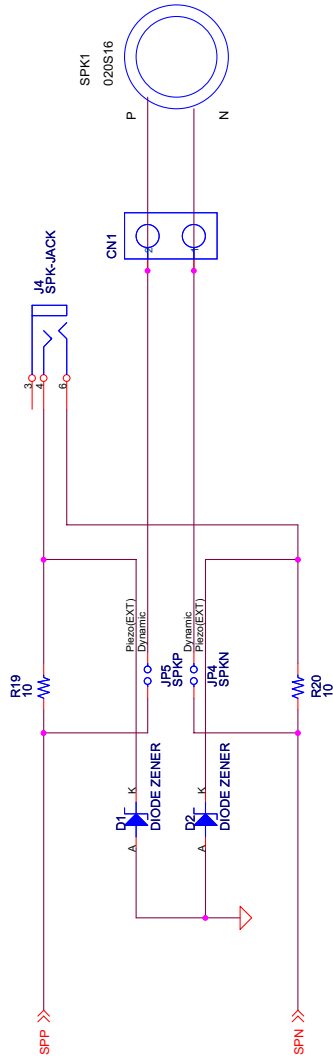
Revision History				
Date (YY/MM/DD)	Manual Revision	Board Revision	Reason	Contents
06/06/20	KM084100	0	First Edition	
06/08/25	KM084101	1	Parts Change	• AK4646 Rev.A → AK4646 Rev.B • C10 4.7nF → 10nF

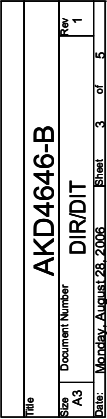
IMPORTANT NOTICE

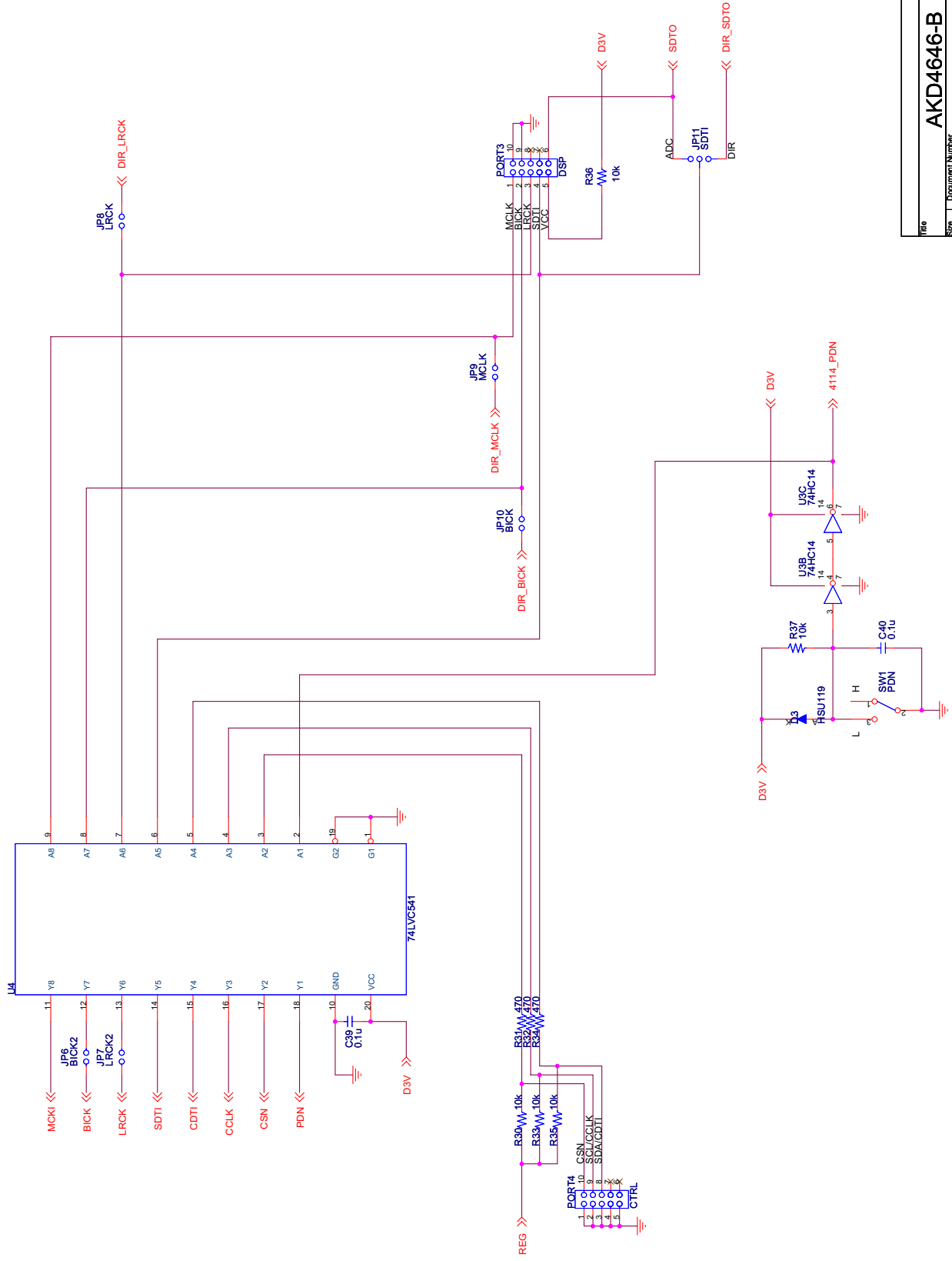
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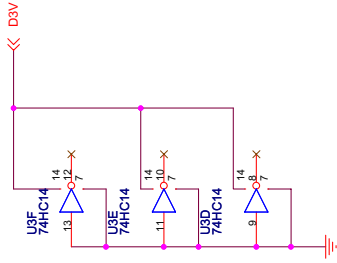
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Date: Monday, August 28, 2006			



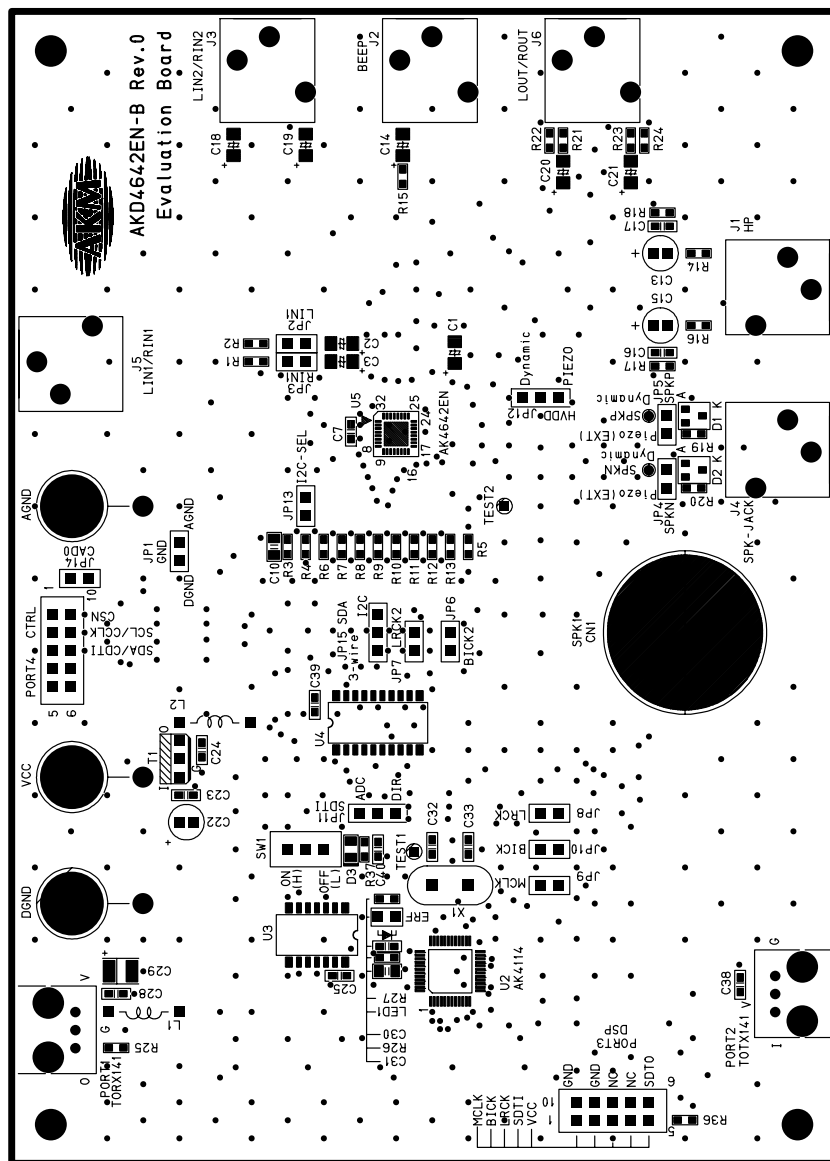




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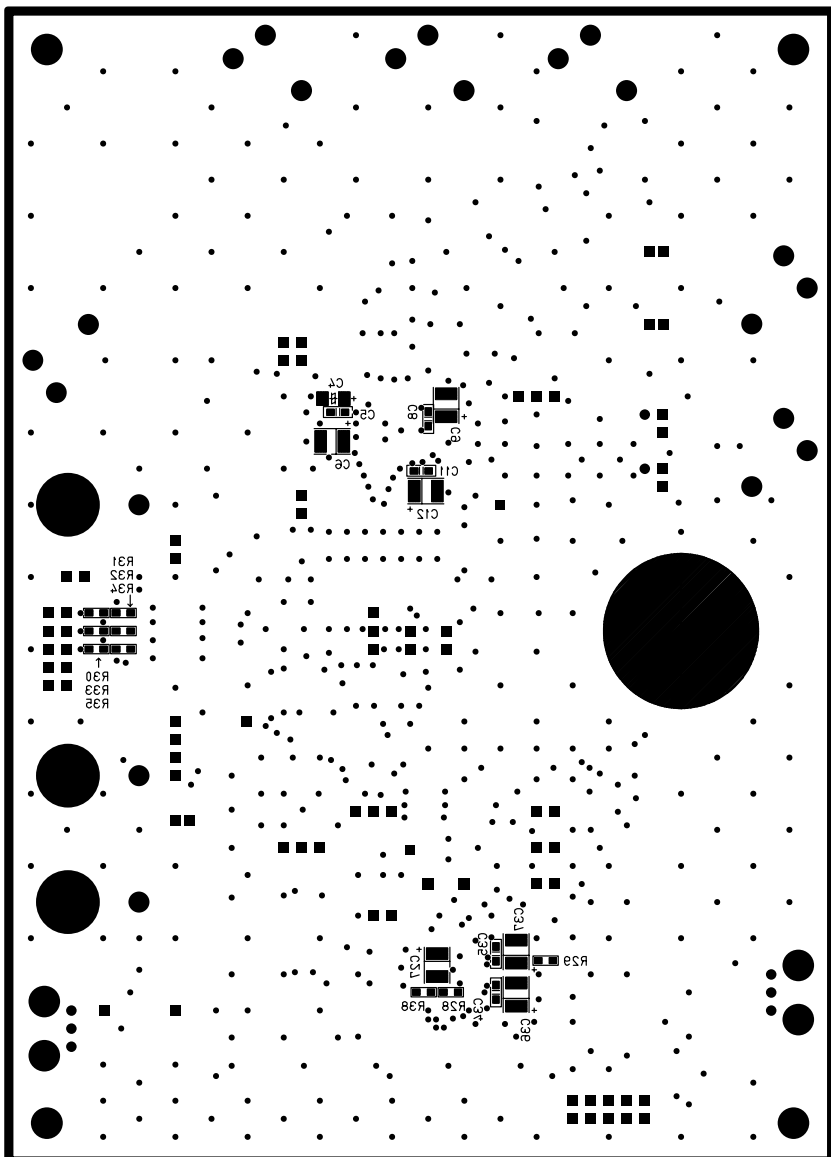


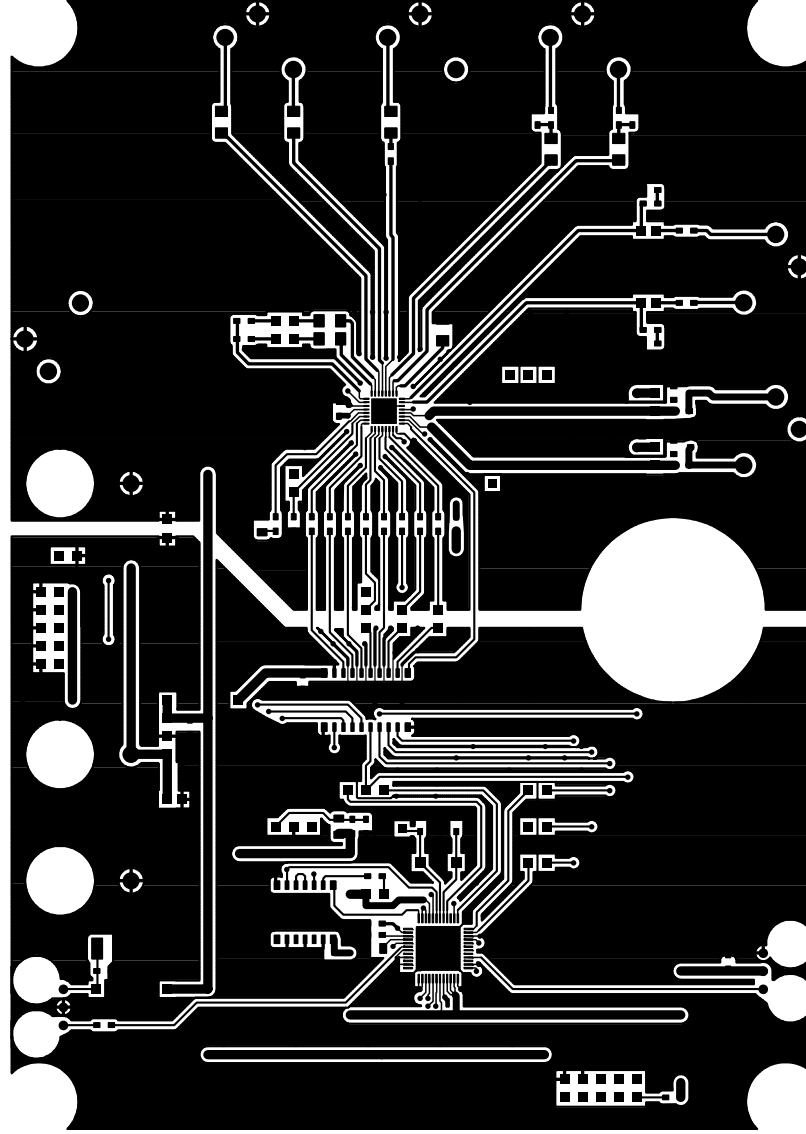
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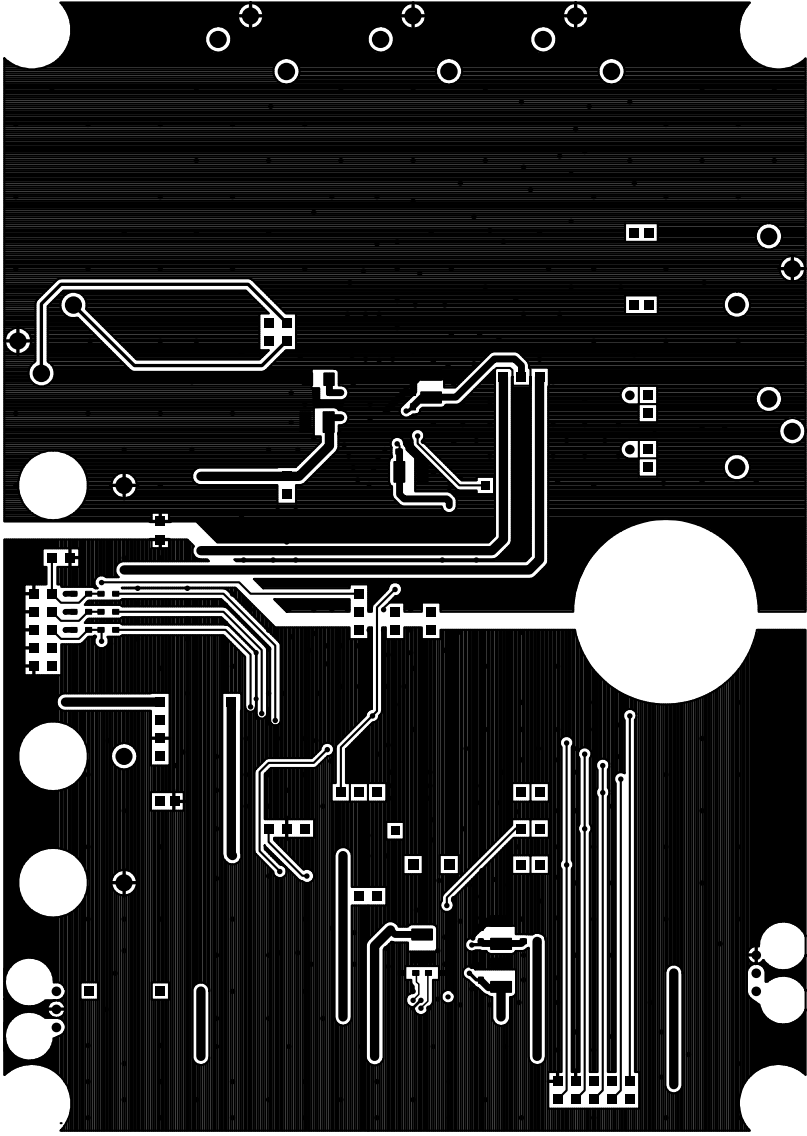
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