GENERAL DESCRIPTION

The AKD5703-B is an evaluation board for the AK5703 4ch 24bit A/D Converter with built-in PLL and MIC Amplifier. On-board USB port enables a GUI on Windows to control various settings. The AKD5703-B has the interface with AKM’s D/A evaluation boards. Therefore, it is easy to evaluate the AK5703. The AKD5703-B also has a digital audio interface, achieving an interface with digital audio systems via opt-connector.

■ Ordering Guide

AKD5703-B--- Evaluation board for AK5703
(Cable for connecting with USB port and control software are included in this package. This control software does not operate on Windows NT.)

FUNCTION

- Compatible with 2 types of interface
  - Direct interface with AKM’s D/A converter evaluation boards
  - DIT/DIR with optical input/output
- USB port for board control

* 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.
   (1-1) In case of supplying the power from a regulator.

   JP15
   USB5V

   Table 1. Set up of power supply lines

<table>
<thead>
<tr>
<th>Name of Jack</th>
<th>Color</th>
<th>Default Setting</th>
<th>Using</th>
</tr>
</thead>
<tbody>
<tr>
<td>REG1</td>
<td>Red</td>
<td>5V</td>
<td>For regulator input</td>
</tr>
<tr>
<td>GND1</td>
<td>Black</td>
<td>0V</td>
<td>Ground</td>
</tr>
</tbody>
</table>

(1-2) In case of using the power supply connectors. <Default>

   JP15
   USB5V

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

(3) Power on.
   The AK5703 and AK4118A must be reset after the power supplies are applied.
   The AK5703 and AK4118A should be reset once by bringing SW1 (Toggle SW) “L” upon power-up. Click
   the Dummy Command button on the control software after releasing the reset by SW1= “H”.

■ Evaluation Mode

In case of using the AK4118A when evaluating the AK5703, audio interface format of both devices must be matched.
Refer to the datasheet for audio interface format of the AK5703, and Table 3 for audio interface format of the
AK4118A. The AK4118A operates on sampling frequency of 32kHz or more. Use other mode, if the sampling
frequency is slower than 32kHz.
In addition, the AK4118A supports MCLK of 256fs and 512fs. Use other mode, when evaluating in a condition except
above.
Refer to the datasheet for register setting of the AK5703.

Applicable Evaluation Mode

(1) Setting in PLL Master Mode.
(2) Setting in PLL Slave Mode (Reference Clock = MCKI).
(3) Setting in PLL Slave Mode (Reference Clock = BICK).
(4) Setting in External Slave Mode. <Default>
(5) Setting in External Master Mode.
(1) PLL Master Mode  
* Connect PORT4 (DSP) with DSP.

In this mode, use the PORT4(DSP). Nothing should be connected to the PORT1 (Opt-In). When an external clock is input to the MCKI pin, MCKO, BICK and LRCK clocks are generated by an internal PLL circuit. SET registers of the AK5703 to PLL Master Mode. Clock frequency should be set to the same as DSP’s specification. Refer to the datasheet of the AK5703 for register definitions of the AK5703.

The figure below shows the PORT4 pin assignment.

<table>
<thead>
<tr>
<th>PORT4</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MCLK</td>
<td>•</td>
<td>GND</td>
</tr>
<tr>
<td>BICK</td>
<td>•</td>
<td>GND</td>
</tr>
<tr>
<td>LRCK</td>
<td>•</td>
<td>NC</td>
</tr>
<tr>
<td>SDTO</td>
<td>•</td>
<td>NC</td>
</tr>
<tr>
<td>VCC</td>
<td>•</td>
<td></td>
</tr>
</tbody>
</table>

SDTO, LRCK and BICK of PORT4 should be connected to SDTI, LRCK, BICK of the DSP. In case of supplying MCKO clock P should be connected to MCLK.

(1-1) Set up jumper pins of MCKI clock
The master clock, 11.2896MHz, 12MHz, 12.288MHz, 13MHz, 13.5MHz, 19.2MHz, 24MHz, 26MHz or 27MHz should be supplied from the MCLK pin of PORT4.

![JP11](MCKI)

(1-2) Set up jumper pins of BICK clock
Output frequency (32fs/64fs/128fs) of BICK should be set by “BCKO1-0 bits” of the AK5703.

![JP13](BICK)

(1-3) Set up jumper pins of LRCK clock

![JP12](LRCK)

(1-4) Set up jumper pins of SDTO
Select the output data from SDTO.

![JP14](SDTO)

In case that signal is output from SDTOA. In case that signal is output from SDTOB.

<KM112900>  2013/02
(2) PLL Slave Mode (PLL Reference Clock: MCKI pin)
* Connect PORT4 (DSP) with DSP.

In this mode, use the PORT4(DSP). Nothing should be connected to the PORT1 (Opt-In). A reference clock of PLL is selected among the input clocks to the MCKI pin. MCKO clock is generated by an internal PLL circuit. BICK and LRCK are input from DSP dividing by MCKO.

SET registers of the AK5703 to PLL Slave Mode (Reference Clock = MCKI). Clock frequency should be set to the same as DSP’s specification. Refer to the datasheet of the AK5703 for register definitions of the AK5703.

The Figure below shows the PORT4 pin assignment.

![PORT4 Pin Assignment](image)

JP9(MCKO) is input to DSP. SDTO, LRCK, BICK of PORT4 should be connected to SDTI, LRCK, BICK of the DSP.

(2-1) Set up jumper pins of MCKI clock

![MCKI Jumper Wiring](image)

(2-2) Set up jumper pins of BICK clock

![BICK Jumper Wiring](image)

(2-3) Set up jumper pins of LRCK clock

![LRCK Jumper Wiring](image)

(2-4) Set up jumper pins of SDTO

Select the output data from SDTO.

![SDTO Jumper Wiring](image)

In case that signal is output from SDTOA. In case that signal is output from SDTOB.
(3) PLL Slave Mode (PLL Reference Clock: BICK pin)  
* Connect PORT4 (DSP) with DSP.

In this mode, use the PORT4 (DSP). A reference clock of PLL is selected among the input clocks to the BICK pin. The required clock to operate the AK5703 is generated by an internal PLL circuit.

SET registers of the AK5703 to PLL Slave Mode (Reference Clock = BICK). Clock frequency should be set to the same as DSP’s specification. Refer to the datasheet of the AK5703 for register definitions of the AK5703.

The figure below shows the PORT4 pin assignment.

SDTO, LRCK, BICK of PORT4 should be connected to SDTI, LRCK, BICK of the DSP. In case of supplying MCKO clock to the DSP, JP9 (MCKO) should be connected to MCLK.

(3-1) Set up jumper pins of MCKI clock

(3-2) Set up jumper pins of BICK clock

(3-3) Set up jumper pins of LRCK clock

(3-4) Set up jumper pins of SDTO

Select the output data from SDTO.

In case that signal is output from SDTOA.  In case that signal is output from SDTOB.
(4) EXT Slave Mode

(4-A) In case of using PORT4
* Connect PORT4 (DSP) with the DSP.

MCKI, BICK and LRCK should be supplied from PORT4. SET registers of the AK5703 to EXT Slave Mode. Refer to the datasheet for register setting of the AK5703.

The figure below shows the PORT4 pin assignment.

<table>
<thead>
<tr>
<th>PORT4</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MCLK</td>
<td>● ●</td>
<td>GND</td>
</tr>
<tr>
<td>BICK</td>
<td>● ●</td>
<td>GND</td>
</tr>
<tr>
<td>LRCK</td>
<td>● ●</td>
<td>NC</td>
</tr>
<tr>
<td>SDTO</td>
<td>● ●</td>
<td>NC</td>
</tr>
<tr>
<td>VCC</td>
<td>● ●</td>
<td></td>
</tr>
</tbody>
</table>

SDTO, LRCK, BICK of PORT4 should be connected to SDTI, LRCK, BICK of the DSP.

(4-A-1) Set up jumper pins of MCKI clock

(4-A-2) Set up jumper pins of BICK clock

(4-A-3) Set up jumper pins of LRCK clock

(4-A-4) Set up jumper pins of SDTO
Select the output data from SDTO.

In case that signal is output from SDTOA. In case that signal is output from SDTOB.
(4-B) In the case of using AK4118A. **(Default)**

*This mode is BICK=64fs, LRCK=1fs only.

In this mode, use the PORT1 (Opt-In). Nothing should be connected to the PORT4(DSP).

The clock of AK4118A use X’tal of X1. The signal of MCKO, BICK and LRCK outputted from the AK4118A is inputted into AK5703.

(4-B-1) Set up jumper pins of MCKI clock

(4-B-2) Set up jumper pins of BICK clock

(4-B-3) Set up jumper pins of LRCK clock

(4-B-4) Set up jumper pins of SDTO

Select the output data from SDTO.

**In case that signal is output from SDTOA.**

**In case that signal is output from SDTOB.**

(5) **EXT Master Mode**

* Connect PORT4 (DSP) with DSP.

When an external clock is input the MCKI, BICK and LRCK are generated by the clock divider of the AK5703.

SET registers of the AK5703 to EXT Master Mode. Refer to the datasheet of the AK5703 for register definitions of the AK5703.

The figure below shows the PORT4 pin assignment.

SDTO, LRCK, BICK of PORT4 should be connected to SDTI, LRCK, BICK of the DSP.
(5-1) Set up jumper pins of MCKI clock

(5-2) Set up jumper pins of BICK clock

(5-3) Set up jumper pins of LRCK clock

(5-4) Set up jumper pins of SDTO
Select the output data from SDTO.

In case that signal is output from SDTOA. In case that signal is output from SDTOB.
■ DIP Switch Setting

[S1]: Mode setting of the AK4118A.
ON is “H”, OFF is “L”.

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>ON (“H”)</th>
<th>OFF (“L”)</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DIF0</td>
<td>AK4118A Audio Format Setting</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>DIF1</td>
<td>See Table 4.</td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Mode Setting of the AK4118A

<table>
<thead>
<tr>
<th>Mode</th>
<th>DIF1</th>
<th>DIF0</th>
<th>DAUX</th>
<th>SDTO</th>
<th>LRCK</th>
<th>BICK</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>24bit, Left justified</td>
<td>24bit, Left justified</td>
<td>H/L</td>
<td>O</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>1</td>
<td>24bit, I’S</td>
<td>24bit, I’S</td>
<td>L/H</td>
<td>O</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>0</td>
<td>24bit, Left justified</td>
<td>24bit, Left justified</td>
<td>H/L</td>
<td>1  64 -128fs</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
<td>24bit, I’S</td>
<td>24bit, I’S</td>
<td>L/H</td>
<td>1  64 -128fs</td>
</tr>
</tbody>
</table>

Table 3. AK4118A Audio Interface Format Setting

■ Jumper Pin Setting

JP17 (CCLK/SCL): CCLK/SCL of the AK5703
SHORT : < Default >

■ Toggle SW Function

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

The AK5703 must be reset after the power supplies are applied.

■ Serial Control

It is possible to control the AKD5703-B via general USB port. Connect a cable with the USB connection (PORT3) on the board and PC.

<table>
<thead>
<tr>
<th>Mode</th>
<th>R26</th>
<th>R23</th>
<th>JP17</th>
<th>JP10</th>
</tr>
</thead>
<tbody>
<tr>
<td>I2C</td>
<td>CAD0=0</td>
<td>CAD0</td>
<td>CCLK/SCL</td>
<td>CSN/CAD0</td>
</tr>
<tr>
<td>3-wire</td>
<td>Open</td>
<td>Open</td>
<td>Short</td>
<td>Short</td>
</tr>
<tr>
<td>I2C</td>
<td>CAD0=1</td>
<td>Short</td>
<td>Short</td>
<td>CAD0</td>
</tr>
</tbody>
</table>

Table 4. Serial Control Setting

Set up jumper pins of JP10

In case that control is 3-wire. In case that control is I2C.
■ Analog Input/Output Circuits

(1) Single-ended Input Circuit<Default>

LIN1 and RIN1 are input to J1. LIN2 and RIN2 are input to J2.

When the Mic Power for MPWRA is not used, JP5 and JP6 should be set to open.
When the Mic Power for MPWRB is not used, JP7 and JP8 should be set to open.
(2) Differential Input Circuit

![Diagram of Differential Input Circuit]

Figure 3. LINA+/RINA-, LINB+/RINB- Input Circuit

<table>
<thead>
<tr>
<th>JP1</th>
<th>JP2</th>
<th>JP3</th>
<th>JP4</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIN1-single</td>
<td>RIN1-single</td>
<td>LIN2-single</td>
<td>RIN2-single</td>
</tr>
</tbody>
</table>

(2-1) In the case of using Mic Power.
R6, R8, R10 and R12 should be mounted 2.2k ohms.

<table>
<thead>
<tr>
<th>JP5</th>
<th>JP6</th>
<th>JP7</th>
<th>JP8</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP-LIN1</td>
<td>MP-RIN1</td>
<td>MP-LIN2</td>
<td>MP-RIN2</td>
</tr>
</tbody>
</table>

(2-2) In the case of not using Mic Power.
R6, R8, R10 and R12 should be set to open.

<table>
<thead>
<tr>
<th>JP5</th>
<th>JP6</th>
<th>JP7</th>
<th>JP8</th>
</tr>
</thead>
<tbody>
<tr>
<td>MP-LIN1</td>
<td>MP-RIN1</td>
<td>MP-LIN2</td>
<td>MP-RIN2</td>
</tr>
</tbody>
</table>

* AKM assumes no responsibility for the trouble when using the above circuit examples.
2. Control Software Manual

■ Evaluation Board and Control Software Settings

1. Set up the evaluation board as needed, according to the previous terms.
2. Connect the evaluation board and PC with a USB cable.
3. The USB control is recognized as HID (Human Interface Device) on the PC.
4. Double-click the icon “akd5703-b.exe” to open the control program.(Note 1)
   When the screen does not display “AKDUSBIF-B” at bottom left, reconnect the PC and the USB cable, and push the [Port Reset] button.
5. Begin evaluation by following the procedure below.

![Figure 4. Window of Control Soft](image-url)
Operation Overview

Function and Register map are controlled by this control software. These controls may be selected by the upper tabs.

Frequently used Buttons, such as the register initializing button “Write Default”, are located outside of the switching tab window. Refer to the “Dialog Box” section for details of each dialog box setting.

1. [Port Reset]: Resets the connection to PC.
   Click this button when connecting USB cable after the control software set up.

2. [Write Default]: Register Initialization.
   When the device is reset by a hardware reset, use this button to initialize the registers.

3. [All Write]: Executes write commands for all registers displayed.

4. [All Read]: Executes read commands for all registers displayed.

5. [Save]: Saves current register settings to a file.

6. [Load]: Executes data write from a saved file.

7. [All Reg Write]: “All Reg Write” dialog box pops up.

8. [Data R/W]: “Data R/W” dialog box pops up.

9. [Sequence]: “Sequence” dialog box pops up.

10. [Sequence(File)]: “Sequence(File)” dialog box pops up.

11. [Read]: Reads current register settings and displays to the register area (on the right of the main window).
   This is different from [All Read] button as it does not reflect to the register map. It only displays register values in hexadecimal numbers.

12. [Dummy Command]: Executes dummy command. (Note 1)

   Note 1. After power up the evaluation board, put SW1 to “L” to power down the AK5703, and return to “H” to release the power-down state. Then, an initialization must be executed by pressing the Dummy Command button.
   Since “Dummy Command” is executed in the following operations, clicking the “Dummy Command” button is not necessary when executing these operations.
   (1) First Read or Write Command after control soft stating.
   (2) First Read or Write Command after “Port Reset”.
   (3) “Write Default”
   (4) “All Write”
   (5) “All Read”
Tab Functions (Note 1)

1. [Function] Tab: Function Control

When a button in the “Function” frame is clicked, a sequential process is executed. When other button is clicked, the setting dialog opens. Refer to the “Dialog Box” section for details of each dialog box setting.

![Figure 5. [Function] Window](image)

[Function] button : Executes a sequential process shown on each button. (Refer to 1-1, [Function] Button)
Setting dialog button : Opens a setting dialog. (Refer to 1-2, Setting Dialog Button)
1- 1. [Function] Button

A function button executes the sequence process shown on the each button and updates several registers. These functions are mainly for path settings.

<table>
<thead>
<tr>
<th>Function Name</th>
<th>Description</th>
<th>Input</th>
<th>Output</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single_End_MIC_In</td>
<td>Single-ended Input (MIC)</td>
<td>LIN1(2), RIN1(2)</td>
<td>SDTOA(B)</td>
<td>LIN1(2), RIN1(2)→MIC-AMP(+30dB)→ADC→VOL→SDTOA(B)</td>
</tr>
<tr>
<td>Differential_MIC_In</td>
<td>Full-differential Input (MIC)</td>
<td>LINA(B)+/-, RINA(B)+/-</td>
<td>SDTOA(B)</td>
<td>LINA(B)+/-,RINA(B)+/-→MIC-AMP(+30dB)→ADC→SDTOA(B)</td>
</tr>
<tr>
<td>Single_End_MIC_IN and HPF/ALC</td>
<td>Single-ended Input (MIC) &amp; HPF &amp; ALC</td>
<td>LIN1(2), RIN1(2)</td>
<td>SDTOA(B)</td>
<td>LIN1(2),RIN1(2)→MIC-AMP(+18dB)→ADC→VOL/HPF/ALC→SDTOA(B)</td>
</tr>
<tr>
<td>Differential_MIC_In and HPF/ALC</td>
<td>Full-differential Input (MIC) &amp; HPF &amp; ALC</td>
<td>LINA(B)+/-, RINA(B)+/-</td>
<td>SDTOA(B)</td>
<td>LINA(B)+/-,RINA(B)+/-→MIC-AMP(+18dB)→ADC→VOL/HPF/ALC→SDTOA(B)</td>
</tr>
<tr>
<td>Single_End_Line_In</td>
<td>Single-ended Input (Line)</td>
<td>LIN1(2), RIN1(2)</td>
<td>SDTOA(B)</td>
<td>LIN1(2),RIN1(2)→MIC-AMP(+0dB)→ADC→VOL→SDTOA(B)</td>
</tr>
</tbody>
</table>

Table 5. Sequence Process Setting

* The setting of Clock mode and I/F mode are hold. The default values are as follows.
  - Clock mode: EXT mode (slave)
  - I/F mode: I2S
  - Sampling Frequency: 44.1 kHz

1- 2. Setting Dialog Button

[System Clock Audio I/F] button: Opens “System Clock & Audio I/F” dialog box.
[Data Output Delay] button: Opens “Programmable Output Data Delay” dialog box.
[ALC Setting] button: Opens “ALC Setting” dialog box.
[Digital Filter Setting] button: Opens “Filter Setting” dialog box.
2. [REG] Tab: Register Map

This tab is for register read and write.

Each bit on the register map is a push-button switch. Button Down indicates “1” and the bit name is shown in red (when read-only the name is shown in dark red). Button Up indicates “0” and the bit name is shown in blue (when read-only the name is shown in gray).

Grayed out registers are Read-Only registers. They cannot be controlled.

The registers which are not defined on the datasheet are indicated as “---”.

![Figure 8. [REG] Window](image-url)
2-1. [Write]: Data Write Dialog

Select the [Write] button located on the right of the each corresponding address when changing two or more bits on the same address simultaneously.

Click the [Write] button located on the right of the each corresponded address for a pop-up dialog box.

When the checkbox next to the register is checked, the data will become “1”. When the checkbox is not checked, the data will become “0”.

Click [OK] to write the set values to the registers, or click [Cancel] to cancel this setting.

![Register Set Window](image)

Figure 9. [ Register Set ] Window

2-2. [Read]: Data Read

Click the [Read] button located on the right of the each corresponding address to execute a register read.

The current register value will be displayed in the register window as well as in the upper right hand DEBUG window.
Button Down indicates “1” and the bit name is shown in red (when read-only the name is shown in dark red).
Button Up indicates “0” and the bit name is shown in blue (when read-only the name is shown in gray)
Dialog Box

1. [Save]: [Save Address of Register] Dialog Box

Click the [Save] button in the main window for save address setting dialog box.

Figure 10. [ Save ] Window

- [All Address] check box: When the [All Address] checkbox is checked, all register settings will be saved.
- [Start Address] edit box: When the [All Address] check box is not checked, set starts register address to save.
- [End Address] edit box: When the [All Address] check box is not checked, set end register address to save.
- [OK] button: Selects a file to save and saves register settings.
- [Cancel] button: Cancel and finish this process.
2. [All Reg Write]: [All Register Write] Dialog Box

Click the [All Reg Write] button in the main window to open register setting file window show below. Register setting files saved by the [SAVE] button may be applied.

![Figure 11. [All Reg Write] Window](image)

- **[Open (left)] button**: Selects a register setting file (*.akr).
- **[Write] button**: Executes register write with selected file setting.
- **[Help] button**: Opens a help window.
- **[Save] button**: Saves a register setting file assignment. File name is “*.mar”.
- **[Open (right)] button**: Opens a saved register setting file assignment “*.mar”.
- **[Close] button**: Closes the dialog box and finish the process.
- **[All Write] button**: Executes all register write. Selected files are executed in descending order.
- **[Start] button**: Start the register writing.
- **[Stop] button**: Stop the register writing.
- **[Interval time]**: Set interval time to start next register setting file. (5msec ~ 10,000msec)
- **[Current No]**: The file number which is being processed is displayed. (File number is assigned 1-10 from top to bottom.)
~ Operating Suggestions ~

1. Files saved by the [Save] button and opened by the [Open] button on the right of the dialog “*.mar” should be stored in the same folder.
2. When register settings are changed by the [Save] button in the main window, re-read the file to reflect new register settings.

3. [Data R/W]: [Data Read/Write] Dialog Box

Click the [Data R/W] button in the main window for data read/write dialog box. Data is written to the specified address.

![Data Read/Write]

Figure 12. [ Data R/W ] Window

- **Address** box: Input data write address in hexadecimal numbers.
- **Data** box: Input write data in hexadecimal numbers.
- **Mask** box: Input mask data in hexadecimal numbers.
  - This value “ANDed” with the write data becomes the input data. Data is changed when corresponding mask bit is “1”.
  - The bits which corresponding Mask bit = “0” are not changed. At this time, data read is not executed, and the storage data of this software is used. “Write Default” must be executed after power up the AK5703 or when the AK5703 is reset by the PDN pin since the storage data and register values are different.
- **Write** button: Writes the data generated from Data and Mask values to the address specified by “Address” box. (Note 2)
- **Read** button: Reads data from the address specified by “Address” box. (Note 2)
  - The result will be shown in the Read Data Box in hexadecimal numbers.
- **Close** button: Closes the dialog box and finishes the process.
  - Data write will not be executed unless [Write] is clicked.

**Note 2.** The register map will be updated after executing [Write] or [Read] commands.
4. [Sequence]: [Sequence] Dialog Box

Click the [Sequence] button in the main window to open register sequence setting dialog box. Register sequence can be set in this dialog box.

![Sequence Setting Dialog Box](image)

**Figure 13. [Sequence] Window**

### ~ Sequence Setting ~

Set register sequence according to the following process.

1. **Select a command**

   Use [Select] pull-down box to choose commands. Corresponding boxes will be valid.

   - **< Select items >**
     - **No_use**: Not using this address
     - **Register**: Register write
     - **Reg(Mask)**: Register write (Masked)
     - **Interval**: Takes an interval
     - **Stop**: Pauses the sequence
     - **End**: Ends the sequence
2. Input sequence

[Address] : Data address
[Data] : Write data
[Mask] : Mask

This value “ANDed” with the write data becomes the input data. The bits which corresponding Mask bit = “0” are not changed. At this time, data read is not executed, and the storage data of this software is used. “Write Default” must be executed after power up the AK5703 or when the AK5703 is reset by the PDN pin since the storage data and register values are different.

This is the actual write data.
When Mask = 0x00, current setting is hold.
When Mask = 0xFF, the 8bit data which is set in the [Data] box is written.
When Mask = 0x0F, lower 4bit data which is set in the [Data] box is written.
Upper 4bit is hold to current setting.

[Interval] : Interval time

Valid boxes for each process command are shown bellow.
No_use : None
Register : [ Address ], [ Data ], [ Interval ]
Reg(Mask) : [ Address ], [ Data ], [ Mask ], [ Interval ]
Interval : [ Interval ]
Stop : None
End : None

~ Control Buttons ~

Functions of Control Button is shown below.

[DEL] button : Checked step is deleted.
[INS] button : The last deleted step is inserted to checked step.
[Start Step] select : Select start step.
   No.1 Step : Start from No.1 step.
   Checked Step : Start from checked step.
[Start] button : Executes the sequence.
[Stop] button : Stops the sequence.
[Help] button : Opens a help window.
[Save] button : Saves sequence settings as a file. The file name is “*.aks”.
[Open] button : Opens a sequence setting file “*.aks”.
[Close] button : Closes the dialog box and finishes the process.

~ Stop of the Sequence ~

When “Stop” is selected in the sequence, the process is paused at this step and restart step number is checked. It starts again from the checked step by clicking the [Start] button. When the process at the end of sequence is finished, “Step No.1” of [start step] is selected automatically.

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5. [Sequence(File)]: [Sequence by *.aks file] Dialog Box

Click the [Sequence (File)] button to open sequence setting file dialog box shown below. Files saved in the “Sequence setting dialog” can be applied in this dialog.

![Sequence by *.aks file](image)

Figure 14. [Sequence(File)] Window

**[Open (left)] button**: Opens a sequence setting file (*.aks)

**[Start] button**: Executes the sequence by the setting of selected file.

**[Start All] button**: Executes all sequence settings. Selected files are executed in descending order.

**[Stop] button**: Stops the sequence process.

**[Help] button**: Opens a help window.

**[Save] button**: Saves a sequence setting file assignment. The file name is “*.mas”.

**[Open (right)] button**: Opens a saved sequence setting file assignment “*.mas”.

**[Close] button**: Closes the dialog box and finishes the process.

~ Operating Suggestions ~

1. Those files saved by [Save] button and opened by [Open] button on the right of the dialog “*.mas” should be stored in the same folder.

2. When “Stop” is selected in the sequence, the process will be paused and a pop-up message will appear. Click “OK” to continue the process.
6. [Power Management MIC Input]: [Power Management & MIC Input] Dialog Box

Click the [Power Management MIC Input] button in the main window to open power management and MIC input setting dialog box.
MIC / Line input, ADC, MIC gain and sensitivity setting are available.
The settings on this dialog are interlocked with the settings on register map.
(Refer to the datasheet for register definitions.)

When PMADxL/R (x = A or B) button is set to ON, PMVCM bit is set to “1” automatically. Note that PMVCM bit does not return to “0” when PMADxL/R button is set to OFF.
When MIXx checkbox is checked, PMADxL/R and PMVCM bit are set to “1” automatically. Note that PMADxL/R and PMVCM bits will not return to “0” when the MIXx box is unchecked. These bits should be set on the register map.
~ Gain Control by Slider ~

The volume can also be changed by slider. When a value is input in the edit box, the slide bar is moved to the value that selected by the edit box. Use the mouse or arrow keys on the keyboard for small adjustments.

![Volume Slider Control](image)

Figure 17. Volume Slider Control
7. [System Clock Audio I/F]: [System Clock & Audio I/F] Dialog Box

Click the [System Clock Audio I/F] button in the main window to open system clock and Audio I/F setting dialog. The settings on this dialog are interlocked with the settings on register map. (Refer to the datasheet for register definitions.)

![System Clock Audio I/F Window](image)

Figure 18. [ System Clock Audio I/F ] Window
8. [Data Output Delay]: [Programmable Output Delay] Dialog Box

Click the [Data Output Delay] button in the main window for setting output data delay. The delay amount of output data is controlled in this dialog. The settings on this dialog are interlocked with the settings on register map. (Refer to the datasheet for register definitions.)

Figure 19. [Data Output Delay] Window
9. [ALC Setting]: [ALC Setting] Dialog Box

Click the [ALC Setting] button in the main window for ALC setting. ALC parameters are controlled in this dialog. The settings on this dialog are interlocked with the settings on register map. (Refer to the datasheet for register definitions.)

![Figure 20. [ALC Setting] Window](image-url)
10. [Digital Filter]: [Filter Setting] Dialog Box

Click the [Digital Filter] button in the main window for Digital Filter setting. Coefficient and frequency of digital filter are calculated on this dialog. (Refer to the datasheet for register definitions.)

![Digital Filter Window](image)

**Figure 21. [Digital Filter] Window**

- **[Register Setting] button**: Opens the register setting dialog.
  - Register writes of a filter factor are also executed.
- **[F Response] button**: Opens the frequency response plot dialog [Filter Plot].
  - Register writes of a filter factor are also executed.
- **[Coefficient Write] button**: Calculation of all the filters and coefficient writing are performed.
- **[Reg Map to Fc/Plot] check box**: When [Reg Map to Fc/Plot] is checked, the coefficient currently written in the register map is reflected to each parameter.
  - Gain of HPF and LPF needs to be set to 1.0. When carrying out coefficient writing by [Coefficient Write] etc. on this dialog, Gain of HPF and LPF is always 1.0.
- **[Close] button**: Closes the dialog box and finishes the process.
10-1. Parameter Setting

Setting the parameter of each filter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Function</th>
<th>Setting Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling Rate</td>
<td>Sampling Frequency (fs)</td>
<td>8, 11.025, 12, 16, 22.05, 24, 32, 44.1, or 48kHz</td>
</tr>
<tr>
<td>HPF1 Cut Off Frequency</td>
<td>High Pass Filter 1 Cut Off Frequency</td>
<td>3.4×fs/44.1 ~ 219.3×fs/44.1 (kHz)</td>
</tr>
<tr>
<td>HPF2 Cut Off Frequency</td>
<td>High Pass Filter 2 Cut Off Frequency</td>
<td>fc/fs ≥ 0.0001</td>
</tr>
<tr>
<td>LPF Cut Off Frequency</td>
<td>Low Pass Filter Cut Off Frequency</td>
<td>fc/fs ≥ 0.05</td>
</tr>
</tbody>
</table>

Table 6. Parameter Setting of [Filter Setting]

Set up ON/OFF of a filter with the check button in [Filter ON/OFF Control]." The filter is ON when the check box is checked.

![Filter ON/OFF Check Box](Figure 22. Filter ON/OFF Check Box)
10-2. [Register Setting]: [Register Setting for Filter] Dialog Box

Click the [Register Setting] button in the filter setting window to open the register setting dialog box shown below. An error message is displayed when a value which is out of a setting range is written, and a calculation of register setting is carried out.

![Register Setting for Filter Dialog Box](image)

Figure 23. [ Register Setting for Filter ] Window

In the following cases, a register set value is updated.
1. When the [Register Setting] button is clicked.
2. When the [F Response] button is clicked.
3. When the [Coefficient Write] button is clicked.
4. When the [UpDate] button on a frequency characteristic display window is clicked.
5. When the Enter key or the Tab key is pressed after setting each parameter.
10-3. [F Response]: [Filter Plot] Dialog Box

Click the [F Response] button in the filter setting window to open the filter post dialog box show below. Filter frequency response of the AK5703 is displayed according to current value of the filter.

![Filter Plot Dialog Box]

Figure 24. [F Response] Window

- [Frequency Range] edit box: The width of the frequency display is specified.
- [Update] button: Redraws the filter characteristics.
- [Gain/Phase] select: “Gain/Phase” display switch.
- [Log View] check button: “Linear/Log” display switch.
- [Close] button: Closes the dialog box and ends the process.

~ Adjustment of a vertical range ~

2. [Vertical slide]: Moves center reference of the Y-axis.
3. [Horizontal slide]: Adjusts scale of the Y-axis.
   (left: shrink, right: expand)
[Measurement Conditions]

- Measurement unit: Audio Precision, System two Cascade
- MCKI: 256fs (11.2896MHz)
- BICK: 64fs
- fs: 44.1kHz
- Bit: 24bit
- Measurement Mode: EXT Slave Mode
- Power Supply: AVDD=TVDD= 3.0V, DVDD=1.8V
- Input Frequency: 1kHz
- Measurement Frequency: 20 ~ 20kHz
- Temperature: Room

[Measurement Results]

<table>
<thead>
<tr>
<th></th>
<th>Result</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lch</td>
<td>Rch</td>
</tr>
<tr>
<td>ADC: LIN1/RIN1 → ADCA →IVOL, IVOL=0dB, ALC=OFF → SDTOA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MGAIN = +30dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S/(N+D) (-1dBFS)</td>
<td>fs=44.1kHz, BW=20kHz</td>
<td>80.6</td>
</tr>
<tr>
<td>DR (-60dBFS, A-Weighted)</td>
<td>84.4</td>
<td>84.4</td>
</tr>
<tr>
<td>S/N (A-weighted)</td>
<td>84.4</td>
<td>84.4</td>
</tr>
<tr>
<td>MGAIN = 0dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S/(N+D) (-1dBFS)</td>
<td>fs=44.1kHz, BW=20kHz</td>
<td>86.5</td>
</tr>
<tr>
<td>DR (-60dBFS, A-Weighted)</td>
<td>96.3</td>
<td>96.1</td>
</tr>
<tr>
<td>S/N (A-weighted)</td>
<td>96.3</td>
<td>96.2</td>
</tr>
</tbody>
</table>

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1. ADC (LIN1/RIN1 $\rightarrow$ ADCA) (+30dB)

AK5703 FFT (LIN1/RIN1$\rightarrow$ADCA) 
[-1dBFS]

Figure 25. FFT (Input level= -1dBFS)

AK5703 FFT (LIN1/RIN1$\rightarrow$ADCA) 
[-60dBFS]

Figure 26. FFT (Input level= -60dBFS)
AK5703 FFT (LIN1/RIN1=>ADCA)
[No Input]

Figure 27. FFT (No Signal)

AK5703 THD+N vs. Input Level (LIN1/RIN1=>ADCA)
[fin=1kHz]

Figure 28. THD+N vs. Input Level
Figure 29. THD+N vs. Input Frequency (C10 and C14: Ceramic Capacitor)
In this case, a ceramic capacitor is used on the LIN1 and RIN1 pins of the AKD5703-B. The performance of the ceramic capacitor is not so good on a low frequency signal. Refer to Figure 30 about the performance of the AK5703.

Figure 30. THD+N vs. Input Frequency (C10 and C14: Electrolytic Capacitor)
AK5703 Linearity (LIN1/RIN1=>ADCA)  
[fin=1kHz]

Figure 31. Linearity

AK5703 Frequency Response (LIN1/RIN1=>ADCA)  
[-1dBFS]

Figure 32. Frequency Response
AK5703 Crosstalk (LIN1/RIN1=>ADCA) 
[-1dBFS]

Figure 33. Crosstalk

2.ADC (LIN1/RIN1 → ADCA) (+0dB)

AK5703 FFT (LIN1/RIN1=>ADCA) 
[-1dBFS]

Figure 34. FFT (Input level= -1dBFS)
AK5703 FFT (LIN1/RIN1=>ADCA)
[-60dBFS]

Figure 35. FFT (Input level= -60dBFS)

AK5703 FFT (LIN1/RIN1=>ADCA)
[No Input]

Figure 36. FFT (No Signal)
AK5703 THD+N vs. Input Level (LIN1/RIN1=>ADCA) 
[fin=1kHz]

Figure 37. THD+N vs. Input Level

AK5703 THD+N vs. Input Frequency (LIN1/RIN1=>ADCA) 
[-1dBFS]

Figure 38. THD+N vs. Input Frequency (C10 and C14: Ceramic Capacitor)
In this case, a ceramic capacitor is used on the LIN1 and RIN1 pins of the AKD5703-B. The performance of a ceramic capacitor is not so good on a low frequency signal. Refer to Figure 39 about the performance of the AK5703.
Figure 39. THD+N vs. Input Frequency (C10 and C14 : Electrolytic Capacitor)

Figure 40. Linearity
AK5703 Frequency Response (LIN1/RIN1=>ADCA) [-1dBFS]

Figure 41. Frequency Response

AK5703 Crosstalk (LIN1/RIN1=>ADCA) [-1dBFS]

Figure 42. Crosstalk
Revision History

<table>
<thead>
<tr>
<th>Date</th>
<th>Manual Revision</th>
<th>Board Revision</th>
<th>Reason</th>
<th>Contents</th>
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<tr>
<td>13/02/12</td>
<td>KM112900</td>
<td>0</td>
<td>First Edition</td>
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