GENERAL DESCRIPTION

The AKD4103A-B is an evaluation board for the AK4103A, 192kHz DIT. The AKD4103A-B has the interface with AKM’s A/D converter evaluation boards and AKM’s DIR evaluation boards. Therefore, it is easy to evaluate the AK4103A. The AKD4103A-B also has the digital audio interface and can achieve the interface with digital audio systems via BNC unbalance or XLR balance connector.

Ordering guide

AKD4103A-B --- Evaluation board for AK4103A
(Control software is packed with this.)

FUNCTION

- Digital interface
- Compatible with 2 types of interface
  - Direct interface with AKM’s ADC, DIR evaluation boards by 10pin header
  - BNC/XLR output

- Serial control data I/F
  - 1 input/output port (10-pin port)

Figure 1. AKD4103A-B Block Diagram
*Circuit diagram and PCB layout are attached at the end of this manual.
Evaluation Board Manual

Operating sequence

(1) Set up the power supply lines.
   
   [+ 5V] (Red) = 5V
   [GND] (Black) = 0V

(2) Set up the evaluation mode and jumper pins. (Refer to the following item.)

(3) Connect cables. (Refer to the following item.)

(4) Power on.
   The AK4103A should be reset once bringing PDN(SW2) “L” upon power-up.

Evaluation modes

(1) Evaluation for DIT
   Serial Data in(10pin port) – AK4103A – S/PDIF out(XLR or BNC)

   MCLK, BICK, LRCK and SDTI are input the via 10pin header (PORT5: DIT). The AKD4103A-B can be connected with the AKM’s DAC evaluation board via 10-line cable.

   a. Set-up of a Bi-phase output signal

      | Connector | JP19 (TXP) |
      |-----------|------------|
      | XLR (J3)  | XLR        |
      | BNC (J4)  | BNC        |

      Table 1. Set-up of TXP

   b. Set-up of clock input and output

      The used signals are MCLK, LRCK, BICK and SDTI (DAUX).
      The signal level outputted and inputted from PORT5 is 5V.

      | Clock       | PORT     |
      |-------------|----------|
      | MCLK        | PORT5    |
      | BICK        | PORT5    |
      | LRCK        | PORT5    |
      | SDTI (DAUX) | PORT5    |

      Table 2. Clock input/output
Table 3. Master Clock Frequency Select

<table>
<thead>
<tr>
<th>CKS1 pin (SW3_5)</th>
<th>CKS0 pin (Sub_JP19)</th>
<th>MCLK</th>
<th>fs (max)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>128fs</td>
<td>28kHz-192kHz</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>256fs</td>
<td>28kHz-108kHz</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>384fs</td>
<td>28kHz-54kHz</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>512fs</td>
<td>28kHz-54kHz</td>
</tr>
</tbody>
</table>

Default

b-1. Set-up of input/output of BICK and LRCK

Please set up SW 3_8 (DIT_I/O) according to the setup of audio format of AK4103A (Refer to Table 5).

<table>
<thead>
<tr>
<th>Audio format</th>
<th>SW3_8 (DIT_I/O)</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slave mode</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Master mode</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Table 4. Set-up of DIT_I/O

c. Set-up of audio data format

It sets up by SW 1_2, SW 1_3 and SW1_4 in synchronous mode. Please set up DIF2-0 bit in asynchronous mode.

<table>
<thead>
<tr>
<th>Mode</th>
<th>DIF2 pin (SW1_4)</th>
<th>DIF1 pin (SW1_3)</th>
<th>DIF0 pin (SW1_2)</th>
<th>SDTI</th>
<th>LRCK</th>
<th>BICK</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DIF2 bit</td>
<td>DIF1 bit</td>
<td>DIF0 bit</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16bit</td>
<td>H/L</td>
<td>32fs-128fs</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>18bit</td>
<td>H/L</td>
<td>36fs-128fs</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>20bit</td>
<td>H/L</td>
<td>40fs-128fs</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>24bit</td>
<td>H/L</td>
<td>48fs-128fs</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>24bit</td>
<td>H/L</td>
<td>48fs-128fs</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>24bit</td>
<td>L/H</td>
<td>50fs-128fs</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>24bit</td>
<td>H/L</td>
<td>64fs</td>
</tr>
<tr>
<td>7</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>24bit</td>
<td>L/H</td>
<td>64fs</td>
</tr>
</tbody>
</table>

Table 5. Audio format
B, C, U, V Inputs (at synchronous mode)

At synchronous mode (ANS=1), C(channel status), U(user data) and V(validity) are input via 10pin header (PORT3: BCUV). BLS is output at normal mode (TRANS=0), and is input at audio routing mode (TRANS=1). In case of audio routing mode, BLS, C, U an V can be directly input from the AKD4114 via 10-line flat cable. The pin layout of PORT3 is shown in Figure 2.

Serial control

The AK4103A can be controlled by pins at synchronous mode (ANS=1) and by internal register at asynchronous mode (ANS=0). Synchronous/Asynchronous mode is set as Table 6.

<table>
<thead>
<tr>
<th>Mode</th>
<th>SW1-6 (ANS)</th>
<th>JP18 (SDA/CDTO)</th>
<th>Sub_JP20 (ANS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchronous</td>
<td>ON</td>
<td>FS3=1: Short “CDTO/CM0=H” side.</td>
<td>Open. Default</td>
</tr>
<tr>
<td></td>
<td></td>
<td>FS3=0: Short “CM0=L” side.</td>
<td></td>
</tr>
<tr>
<td>Asynchronous</td>
<td>OFF</td>
<td>Short “CDTO/CM0=H” side.</td>
<td>Short.</td>
</tr>
</tbody>
</table>

Table 6. Synchronous/Asynchronous mode

At asynchronous mode (ANS=0), the AK4103A can be controlled via the printer port (parallel port) of IBM-AT compatible PC. Connect PORT6 (uP-I/F) with PC by 10-line flat cable packed with the AKD4103A-B. Take care of the direction of connector. There is a mark at pin#1. The pin layout of PORT6 is shown in Figure 3.

Control software is packed with the AKD4103A-B. The software manual is included in this eva-board manual.
### Toggle switch set-up

<table>
<thead>
<tr>
<th>Switch</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SW2</td>
<td>PDN</td>
</tr>
<tr>
<td></td>
<td>Reset switch for AK4103A. Set to “H” during normal operation. Bring to “L” once after the power is supplied.</td>
</tr>
</tbody>
</table>

### DIP switch (SW1) set-up: -off- means “L”

<table>
<thead>
<tr>
<th>No.</th>
<th>Switch Name</th>
<th>Function</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>IPS0</td>
<td>Don’t care</td>
<td>OFF</td>
</tr>
<tr>
<td>2</td>
<td>DIF0</td>
<td>Set-up of DIF0 pin. (in synchronous mode)</td>
<td>OFF</td>
</tr>
<tr>
<td>3</td>
<td>DIF1</td>
<td>Set-up of DIF1 pin. (in synchronous mode)</td>
<td>OFF</td>
</tr>
<tr>
<td>4</td>
<td>DIF2</td>
<td>Set-up of DIF2 pin. (in synchronous mode)</td>
<td>ON</td>
</tr>
<tr>
<td>5</td>
<td>IPS1/IIC</td>
<td>Don’t care</td>
<td>OFF</td>
</tr>
<tr>
<td>6</td>
<td>ANS</td>
<td>Set-up of ANS pin. “L”: asynchronous mode, “H”: synchronous mode</td>
<td>OFF</td>
</tr>
<tr>
<td>7</td>
<td>TEST</td>
<td>Don’t care</td>
<td>OFF</td>
</tr>
<tr>
<td>8</td>
<td>ACKS</td>
<td>Don’t care</td>
<td>OFF</td>
</tr>
</tbody>
</table>

### DIP switch (SW3) set-up: -off- means “L”

<table>
<thead>
<tr>
<th>No.</th>
<th>Switch Name</th>
<th>Function</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>FS1</td>
<td>Sampling frequency select at synchronous mode (ANS=1). (See the datasheet.)</td>
<td>OFF</td>
</tr>
<tr>
<td>2</td>
<td>FS2</td>
<td>(See the datasheet.)</td>
<td>OFF</td>
</tr>
<tr>
<td>3</td>
<td>FS0</td>
<td>Don’t care</td>
<td>OFF</td>
</tr>
<tr>
<td>4</td>
<td>PSEL</td>
<td>Don’t care</td>
<td>OFF</td>
</tr>
<tr>
<td>5</td>
<td>CKS1</td>
<td>Set-up of CKS1 pin. (in synchronous mode)</td>
<td>OFF</td>
</tr>
<tr>
<td>6</td>
<td>TRANS</td>
<td>Set-up of TRANS pin. “L”: normal mode, “H”: audio routing mode</td>
<td>OFF</td>
</tr>
<tr>
<td>7</td>
<td>DIR_I/O</td>
<td>Don’t care</td>
<td>OFF</td>
</tr>
<tr>
<td>8</td>
<td>DIT_I/O</td>
<td>Set-up of the transmission direction of 74AC245 “L”: When inputting from PORT5, “H”: When outputting from PORT5</td>
<td>OFF</td>
</tr>
</tbody>
</table>

### Jumper set up.

<table>
<thead>
<tr>
<th>No.</th>
<th>Jumper Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D3V/VD</td>
<td>Set-up of Power supply source for 74AC245. D3V : D3V, BD : BD (default)</td>
</tr>
<tr>
<td>18</td>
<td>SDA/CDTO</td>
<td>Set-up of FS3 pin Synchronous mode: short “CDTO/CM0=H” → FS3 pin=“H” short “CM0=L” → FS3 pin=“L” Asynchronous mode: short “CDTO/CM0=H” (default)</td>
</tr>
<tr>
<td>19</td>
<td>TXP1</td>
<td>Set-up of TXP1 output circuit. OPT : Not to Use, XLR : XLR, BNC : BNC (default)</td>
</tr>
<tr>
<td>19(sub)</td>
<td>CKS0</td>
<td>Set-up of CKS0 pin Open : CKS0 pin=“H” (default) Short : CKS0 pin=“L”</td>
</tr>
<tr>
<td>20(sub)</td>
<td>ANS</td>
<td>Set-up depending synchronous / asynchronous mode Open : synchronous mode Short : asynchronous mode (default)</td>
</tr>
</tbody>
</table>
Control Soft Manual

Evaluation Board and Control Soft Settings

1. Set an evaluation board properly.
2. Connect a USB control box (AKUSBIF-B) and an evaluation board.
   Pay attention about direction of the 10pin header when connecting to an AKUSBIF-B.
3. Connect a PC (IBM-AT compatible) and the USB control box (AKUSBIF-B).
   The USB control box is recognized as HID (Human Interface Device) on the PC.
   It is not necessary to install a new driver.
4. Start up the control program.
   When the screen does not display “AKUSBIF-B” at bottom left, reconnect the PC and the USB control box, and push the [Port Reset] button.
5. Proceed evaluation by following the process below.

Support OS
Windows XP / Vista / 7 (32bit) (XP compatible mode is recommended for Vista / 7)
64bit OS’s are not supported.

Figure 4. Window of [FUNCTION]
Operation Overview

Function, register map and testing tool can be controlled by this control soft. These controls are selected by upper tabs. Buttons which are frequently used such as register initializing button “Write Default”, are located outside of the switching tab window. Refer to the “Dialog Boxes” for details of each dialog box setting.

1. [Port Reset]: For when connecting to USB I/F board (AKDUSBIF-B)
   Click this button after the control soft starts up when connecting USB I/F board (AKDUSBIF-B).

2. [Write Default]: Initializes Registers
   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 Req Write]: Opens “All Req Write” dialog box.

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

9. [Sequence]: Opens “Sequence” dialog box.

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

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

[All Req Write]

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

Figure 5. Window of [All Reg Write]

[Open (left)]: Selecting a register setting file (*.akr).
[Write]: Executing register writing.
[Write All]: Executing all register writings.
Writings are executed in descending order.
[Help]: Help window is popped up.
[Save]: Saving the register setting file assignment. The file name is “*.mar”.
[Open (right)]: Opening a saved register setting file assignment “*.mar”.
[Close]: Closing the dialog box and finish the process.

*Operating Suggestions
(1) Those files saved by [Save] button and opened by [Open] button on the right of the dialog “*.mar” should be stored in the same folder.
(2) When register settings are changed by [Save] button in the main window, re-read the file to reflect new register settings.
[Data R/W]

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

![Data Read/Write dialog box]

- **Address Box**: Input data address in hexadecimal numbers for data writing.
- **Data Box**: Input data in hexadecimal numbers.
- **Mask Box**: Input mask data in hexadecimal numbers. This is “AND” processed input data.
- **[Write]**: Writing to the address specified by “Address” box.
- **[Close]**: Closing the dialog box and finish the process.
  
  Data writing can be cancelled by this button instead of [Write] button.

*The register map will be updated after executing [Write] or [Read] commands.*
[Sequence]

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

Sequence Setting

Set register sequence by following process below.

1. Select a command

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

   <Select Pull-down menu>
   
   - No_use: Not using this address
   - Register: Register writing
   - Reg(Mask): Register writing (Masked)
   - Interval: Taking an interval
   - Stop: Pausing the sequence
   - End: Finishing the sequence

2. Input sequence

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

   [Data] box data is ANDed with [Mask] box data. This is the actual writing 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

Figure 7. Window of [Sequence]
Valid boxes for each process command are shown below.

- **No_use**: None
- **Register**: [Address], [Data], [Interval]
- **Reg(Mask)**: [Address], [Data], [Mask], [Interval]
- **Interval**: [Interval]
- **Stop**: None
- **End**: None

### Control Buttons

The function of Control Button is shown below.

- **[Start]**: Executing the sequence
- **[Help]**: Opening a help window
- **[Save]**: Saving sequence settings as a file. The file name is “*.aks”.
- **[Open]**: Opening a sequence setting file “*.aks”.
- **[Close]**: Closing the dialog box and finish the process.

### Stop of the sequence

When “Stop” is selected in the sequence, processing is paused and it starts again when [Start] button is clicked. Restarting step number is shown in the “Start Step” box. When finishing the process until the end of sequence, “Start Step” will return to “1”.

The sequence can be started from any step by writing the step number to the “Start Step” box. Write “1” to the “Start Step” box and click [Start] button, when restarting the process from the beginning.
[Sequence(File)]
Click [Sequence(File)] button to open sequence setting file dialog box. Those files saved in the “Sequence setting dialog” can be applied in this dialog.

![Sequence(File) window]

- [Open (left)]: Opening a sequence setting file (*.aks).
- [Start]: Executing the sequence setting.
- [Start All]: Executing all sequence settings. Sequences are executed in descending order.
- [Help]: Pop up the help window.
- [Save]: Saving sequence setting file assignment. The file name is “*.mas”.
- [Open(right)]: Opening a saved sequence setting file assignment “*.mas”.
- [Close]: Closing the dialog box and finish 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.

![Sequence Pause window]

Figure 8. Window of [Sequence(File)]

Figure 9. Window of [Sequence Pause]
1. [REG]: Register Map

This tab is for a register writing and reading.

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

Grayout registers are Read Only registers. They can not be controlled.

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

Figure 10. Window of [REG]
**[Write]: Data Writing Dialog**

It is for when changing two or more bits on the same address at the same time.

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

When checking the checkbox, the register will be “H” or “1”, when not checking the register will be “L” or “0”. Click [OK] to write setting value to the registers, or click [Cancel] to cancel this setting.

![Figure 11. Window of [ Register Set ]](image)

**[Read]: Data Read**

Click [Read] button located on the right of the each corresponded address to execute register reading.

After register reading, the display will be updated regarding to the register status.
Button Down indicates “H” or “1” and the bit name is in red (when read only it is in deep red).
Button Up indicates “L” or “0” and the bit name is in blue (when read only it is in gray)

Please be aware that button statuses will be changed by Read command.
### Revision History

<table>
<thead>
<tr>
<th>Date (yy/mm/dd)</th>
<th>Manual Revision</th>
<th>Board Revision</th>
<th>Reason</th>
<th>Page</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/11/22</td>
<td>KM076800</td>
<td>0</td>
<td>First edition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/11/21</td>
<td>KM076801</td>
<td>0</td>
<td>Modification</td>
<td>2</td>
<td>Block diagram at DIT Evaluation was added.</td>
</tr>
<tr>
<td>10/03/05</td>
<td>KM076802</td>
<td>0</td>
<td>Change</td>
<td>6-14</td>
<td>“Control Soft Manual” was changed.</td>
</tr>
<tr>
<td>11/07/27</td>
<td>KM076803</td>
<td>0</td>
<td>Change</td>
<td>6-14</td>
<td>“Control Soft Manual” was changed.</td>
</tr>
<tr>
<td>15/08/11</td>
<td>KM076804</td>
<td>1</td>
<td>Change</td>
<td>19</td>
<td>Circuit diagram was changed. PORT4: “Mount” -&gt; “No Mount”</td>
</tr>
</tbody>
</table>
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