# AKD4516A

## Evaluation board Rev.A for AK4516A

### General description

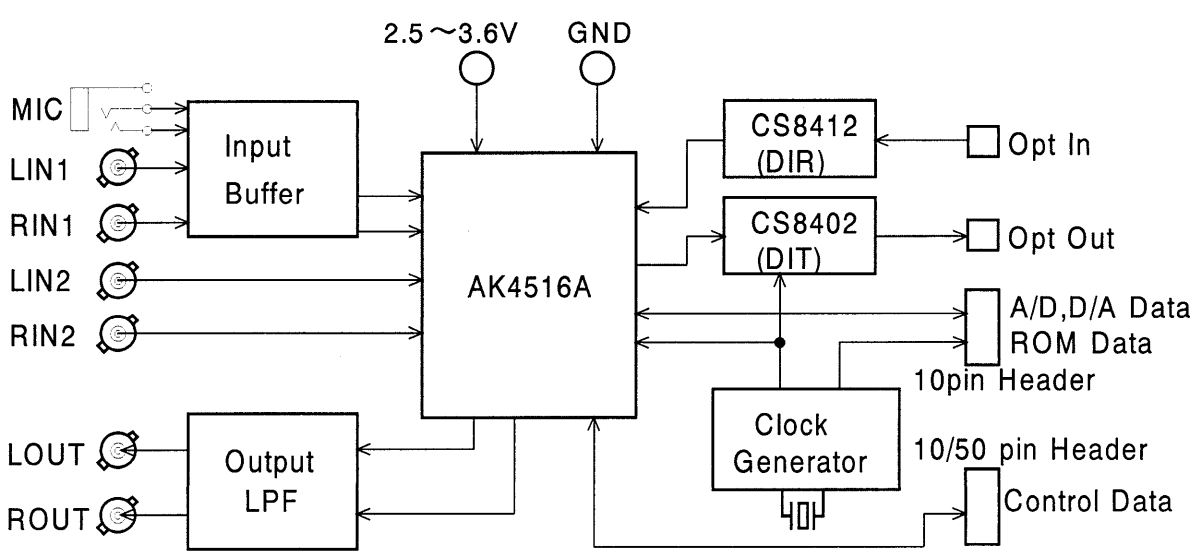
AKD4516A is an evaluation board for the digital stereo audio 16bit A/D and D/A converter, AK4516A. The A/D converter section includes the MIC circuit, the D/A converter section includes the 2nd order LPF. The AKD4516A can evaluate A/D converter and D/A converter separately in addition to loopback mode(A/D → D/A). The A/D converter section can be evaluated by interfacing with AKM's DAC evaluation boards (AKD4324, AKD4321, AKD4320, AKD4319) directly. The AKD4516A has the interface with AKM's wave generator using ROM data and AKM's ADC evaluation boards (AKD5392, AKD5391, AKD5351 and AKD5351). Therefore, it is easy to evaluate the D/A section, The AKD4516A also has the digital audio interface and can achieve the interface with digital audio system via opt-connector.
The AK4516A is supplied by a 24pin VSOP. When shipping, the AKD4516A attaches the directly AK4516A to the AKD4516A. But the AKD4516A supplies a 24pin VSOP socket in the Sub-Board by request. Therefore, enables easier evaluation of other AK4516A devices.

■ Ordering Guide

AKD4516A --- Evaluation board for AK4516A
AKD4516A Sub-Board --- Evaluation Sub-board for AK4516A

### Function

- ☐ On-board MIC Input Buffer Circuit
- ☐ On-board 2nd order LPF for Analog Output
- ☐ On-board clock generator
- ☐ Compatible with following 2 types of interface
  - 1)Direct interface with AKM's A/D and D/A converter, and direct interface with a signal generator(AKD43XX) by 10pin Header
  - 2) DIT/DIR with optical input/output
- ☐ A BNC connector for an external clock input



[JP2] Don't care

[JP3] Short: $\overline{CS}$ pin is pulled-up by a resistor of 47k ohms.
This mode is only used to evaluate analog characteristics of the AK4516A.
Then the AKD4516A can not be controlled by external uP or personal computer.
Open: $\overline{CS}$ pin can be controlled by PORT1 or P1.

[JP4] PIO: A data of CDTO pin is output from PORT1 and P1.
CDTIO: 3-wires interface can be controlled by connecting CDTI pin to CDTO pin.
In this case, only PORT1 can be input/output.

[JP5] PIO: A data of CDTI pin is input to PORT1 and P1.
CDTIO: 3-wires interface can be controlled by connecting CDTI pin to CDTO pin.
In this case, only PORT1 can be input/output.

4. Jumper set up and explanation

[JP6] Short VD+ and VP+.
In case of separating VD+ and VP+ supplies, JP6 should be open.

■ The function of the toggle SW

[SW1] Reset the AK4516A. In case of "L" position, AK4516A becomes power-down status. In case of "H" position, AK4516A becomes normal operation.
[SW3] Reset the CS8402. "L" position resets the internal counter of CS8402, then Bi-phase signal is not output. Keep "H" position during normal operation.

■ The indication content for LED

[D3] Monitor VERF pin of the CS8412. LED turns on when some error has occurred to CS8412.
[D4] Indicates whether the input data is pre-emphasized or not. LED turns on when the data is pre-emphasized.

■ DIP switch set up

Confirm the set up of the DIP-SW before evaluation starts. ON means "1", OFF, "0".

1. SW5: Set up the operation modes of the CS8412
   Set up the CS8412's(DIR) data format corresponding the serial data interface of the AK4516A.
   Don't forget that JP16(BCF2) should be set up.

| No. | PIN | ON | OFF | |
|---|---|---|---|---|
| 1 | CS12 | Rch | Lch | *2 |
| 2 | M0 | Refer to Table 2. | | *Be careful of a row of M0-3. |
| 3 | M2 | | | |
| 4 | M1 | | | |
| 5 | M3 | | | |
| 6 | SEL | Normally ON *1 | | |

*1 When "ON", it shows pre-emphasis on EMPH. (LED turns on)
*2 Select the channel whose status is represented.

Table 1. DIP SW set up of the CS8412.
(Refer to the CS8412 data sheet.)

| No. | AK4516A's DIF0 bit | AK4516A's DIF1 bit | AK4516A's SDI(DAC) | SW5-5 M3 | SW5-4 M1 | SW5-3 M2 | SW5-2 M0 | JP16 BCF2 | |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | LSB, justified | 0 | 0 | 1 | 1 | R | *3 |
| 1 | 1 | 0 | LSB, justified | 0 | 0 | 1 | 1 | R | |
| 2 | 0 | 1 | MSB, justified | 0 | 0 | 0 | 0 | F | |
| 3 | 1 | 1 | IIS compatible | 0 | 1 | 0 | 0 | R | |

*3 Default

Table 2. Set up Audio Data Format of DIR
(DIF1 and DIF0 bits are changed by the internal register of the AK4516A.)

[JP16:BCF2]: Define the polarity of BICK from outputting CS8412(DIR).
F: BCLK is inverted.
R: BCLK coincides with AK4516A

2. SW4: Set up the operation mode of CS8402(DIT)
   Set up the CS8402's(DIT) data format corresponding the serial data interface of the AK4516A.
   Don't forget that JP7(BCF1) should be set up.

| No. | AK4516A's DIF0 bit | AK4516A's DIF1 bit | AK4516A's SDI(ADC) | SW4-1 M2 | SW- 2 M1 | SW4-3 M0 | JP7 BCF1 | |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | MSB, justified | 0 | 0 | 1 | F | *4 |
| 1 | 1 | 0 | LSB, justified | 1 | 0 | 1 | R | *5 |
| 2 | 0 | 1 | MSB, justified | 0 | 0 | 1 | F | |
| 3 | 1 | 1 | IIS compatible | 1 | 0 | 0 | R | |

*4 Defalut
*5 JP9(BICK):64fs

Table 3. DIP SW set up of the CS8402(DIT)
(DIF1 and DIF0 bits are changed by the internal register of the AK4516A.)
(Refer to the CS8402 data sheet.)

[JP7:BCF1]: Define the polarity of BCLK from outputting CS8402(DIT).
F: BCLK is inverted.
R: BCLK coincides with AK4516A

3. SW2: This switch sets the C-bit of CS8402. (Default is the consumer mode)

This set up does not affect the evaluation of the AK4516A. In case of using DIT, need to set it up correctly. For more detailed configurations, please refer to the CS8402 data-sheet.

| Switch | OFF=0,ON=1 | Contents |
|---|---|---|
| 8 | $\overline{\text{PRO}}$=0 | Professional mode, C0=1 |
| 6,7 | $\overline{\text{C6}}$,$\overline{\text{C7}}$ | C6,C7 - Sampling frequency |
| | 1 1 | 00 - Not indicated. Receiver default to 48kHz. |
| | 1 0 | 01 - 48kHz |
| | 0 1 | 10 - 44.1kHz |
| | 0 0 | 11 - 32kHz |
| 5 | $\overline{\text{C9}}$ | C8,C9,C10,C11 - 1bit of channel mode |
| | 1 | 0000 - Mode not indicated. Receiver default to 2-channel mode. |
| | 0 | 0100 - Stereophonic. |
| 4 | $\overline{\text{C1}}$ | C1 - Audio mode |
| | 1 | 0 - Normal audio |
| | 0 | 1 - Not audio |
| 3 | TRNPT | Transparent mode *CS8402 is CRE |
| | 0 | Normal mode |
| | 1 | Transparent mode |
| 1,2 | EM1,EM0 | C2,C3,C4 - Encoded audio signal emphasis |
| | 1 1 | 000 - Emphasis not indicated. Receiver defaults to no emphasis with manual override enable. |
| | 1 0 | 100 - None |
| | 0 1 | 110 - 50/15usec |
| | 0 0 | 111 - CCITT J.17 |

Table 4. DIP switch set up of CS8402 (Professional mode)

| Switch | OFF=0,ON=1 | Contents |
|---|---|---|
| 8 | $\overline{\text{PRO}}$=1 | Consumer mode, C0=0 (Default) |
| 7 | $\overline{\text{C2}}$ | C2 - Copy |
| | 1 | 0 - Copy inhibited |
| Default | 0 | 1 - Copy permitted |
| 6 | $\overline{\text{C3}}$ | C3,C4,C5 - Pre-emphasis |
| Default | 1 | 000 - None |
| | 0 | 100 - 50/15usec |
| 5 | $\overline{\text{C15}}$ | C15 - Generation Status |
| | 1 | 0 - See the standard |
| Default | 0 | 1 - See the standard |
| 3,4 | FC1,FC0 | C24,C25,C26,C27- Sampling frequency |
| | 0 0 | 0000 - 44.1kHz |
| Default | 0 1 | 0100 - 48kHz |
| | 1 0 | 1100 - 32kHz |
| | 1 1 | 0000 - 44.1kHz, CD mode |
| 1,2 | $\overline{\text{C8}}$,$\overline{\text{C9}}$ | C8-C14 - Category code |
| Default | 1 1 | 0000000 - General |
| | 1 0 | 0100000 - PCM encoder/decoder |
| | 0 1 | 1000000 - CD |
| | 0 0 | 1100000 - DAT |

Table 5. DIP switch set up of CS8402(Consumer mode)

AK4516A Measurement Result Examples

■ Dynamic Characteristics

[ Measurement conditions ]

- Measurement Unit : Audio Precision, System One
- Sampling frequency(fs) : 44.1kHz
- BCLK : 64fs
- Power Supply : VA+=VP+=3.0V, VD+=4.0V
- Interface : DIT/DIR
- Temperature : Room temperature
- Response : RMS mode

1. Analog through mode (PM3-0:09H)

| Parameter | Input signal | Measurement Filter | Results |
|---|---|---|---|
| S/(N+D) | 1kHz,0dB | 20kHzLPF | 89.4dB |
| DR | 1kHz,-60dB | 20kHzLPF | 89.7dB |
| | 1kHz,-60dB | 22kHzLPF + A-weight | 92.8dB |
| S/N | 1kHz,0dB/GND IN | 20kHzLPF | 89.7dB |
| | 1kHz,0dB/GND IN | 22kHzLPF + A-weight | 92.8dB |

* 0dB is full scale of ADC input.

2. IPGA + ADC Output

- Bandwidth : 20 ~ 20kHz

| Parameter | Input signal | Additional Filter | Results |
|---|---|---|---|
| S/(N+D) | 1kHz,-2dB | | 85.4dB |
| DR | 1kHz,-60dB | | 86.2dB |
| S/N | 1kHz,0dB/GND IN | | 86.3dB |
| | 1kHz,0dB/GND IN | A-weight | 90.2dB |

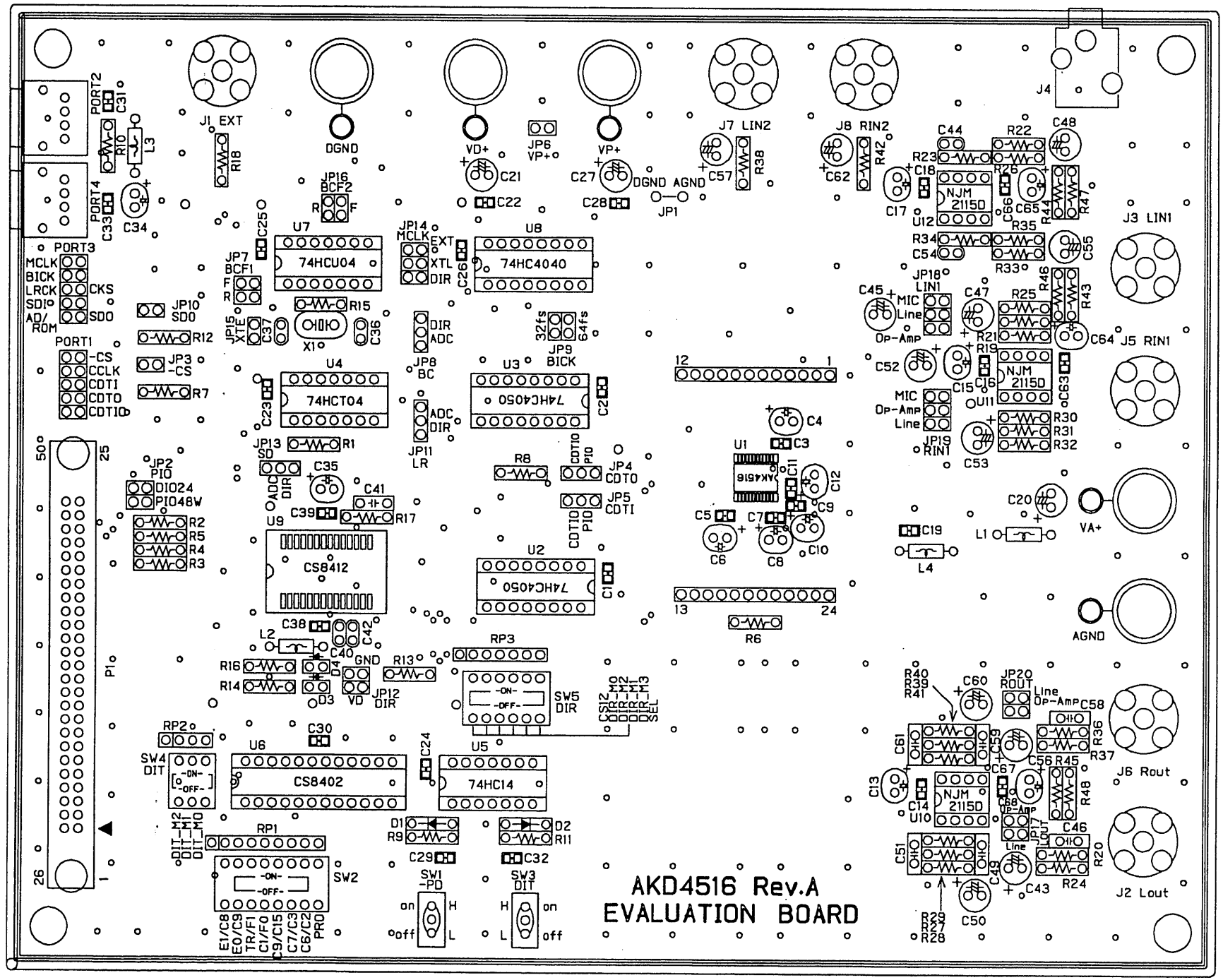
* 0dB is full scale of ADC input.

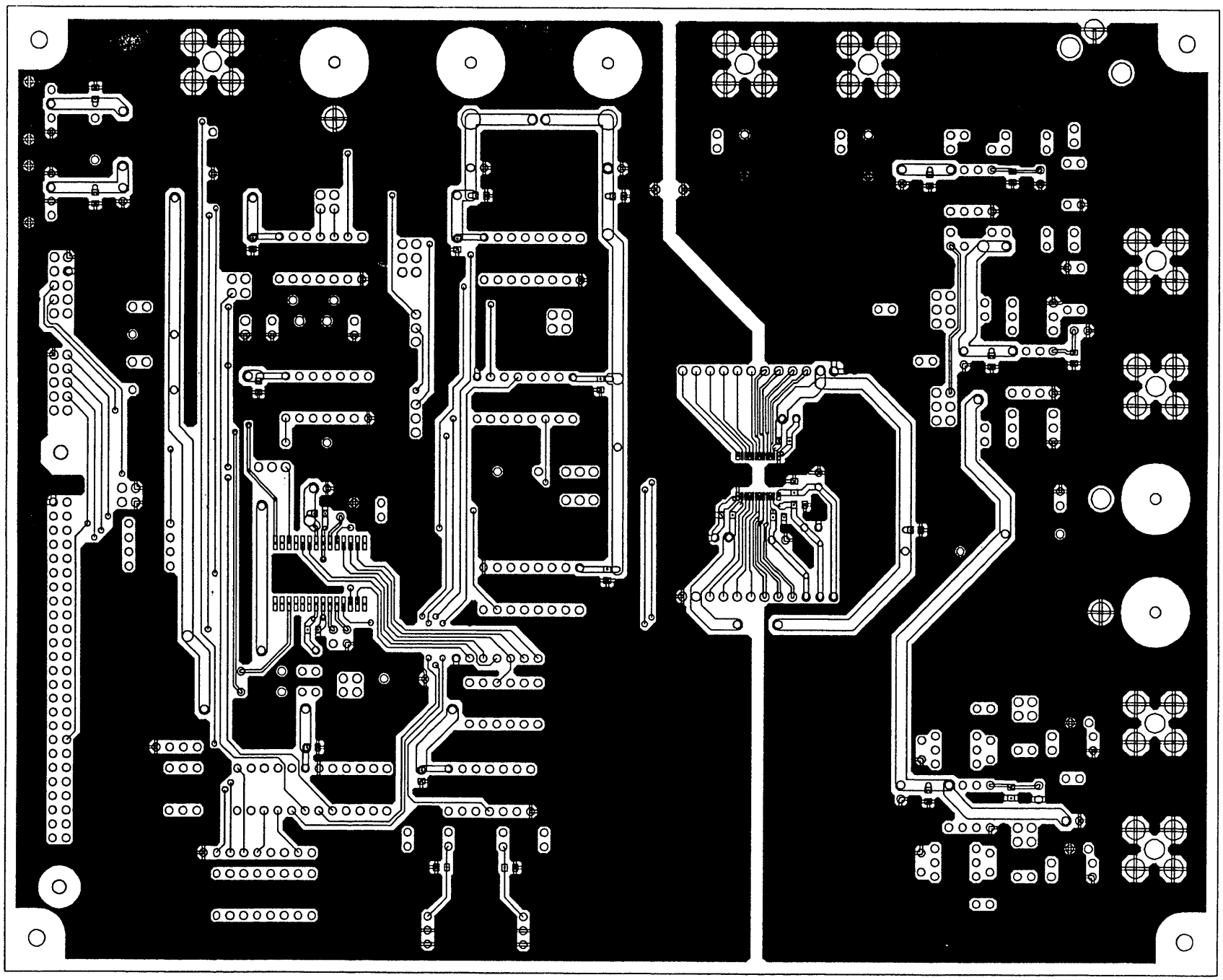
3. DAC Output (External filter none)

| Parameter | Input signal | Measurement Filter | Results |
|---|---|---|---|
| S/(N+D) | 1kHz,0dB | 20kHzLPF | 86.5dB |
| DR | 1kHz,-60dB | 20kHzLPF | 87.2dB |
| | 1kHz,-60dB | 22kHzLPF + A-weight | 89.7dB |
| S/N | 1kHz,0dB/GND IN | 20kHzLPF | 87.4dB |
| | 1kHz,0dB/GND IN | 22kHzLPF + A-weight | 90.5dB |

4. IPGA + ADC → DAC Loopback (External filter none)

| Parameter | Input signal | Measurement Filter | Results |
|---|---|---|---|
| S/(N+D) | 1kHz,-2dB | 20kHzLPF | 82.8dB |
| DR | 1kHz,-60dB | 20kHzLPF | 83.9dB |
| | 1kHz,-60dB | 22kHzLPF + A-weight | 86.7dB |
| S/N | 1kHz,0dB/GND IN | 20kHzLPF | 83.4dB |
| | 1kHz,0dB/GND IN | 22kHzLPF + A-weight | 86.3dB |


AKD4516 Rev.A
EVALUATION BOARD
J1 EXT
DGND
VD+
VP+
DGND AGND
J4
J7 LIN2
J8 RIN2
J3 LIN1
J5 RIN1
J6 Rout
J2 Lout
VA+
AGND
PORT1
PORT2
PORT3
PORT4
P1
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
74HCU04
74HC4040
74HCT04
74HC4050
CS8412
CS8402
74HC14
NJM 2115D
AK4516
SW1 -PD
SW2
SW3 DIT
SW4 DIT
SW5 DIR
JP1
JP2 PIO
JP3 -CS
JP4 CDTO
JP5 CDTI
JP6 VP+
JP7 BCF1
JP8 BC
JP9 BICK
JP10 SDO
JP11 LR
JP12 DIR
JP13 SD
JP14 MCLK
JP15 XTE
JP16 BCF2
JP18 LIN1
JP19 RIN1
JP20 ROUT
MCLK
BICK
LRCK
SDI
AD/ DAT
CKS
SDO
-CS
CCLK
CDTI
CDTO
CDTIO
DIO24
PIO48W
MIC
Line
Op-AMP
DIR
ADC
EXT
XTL
32fs
64fs
GND
VD
-ON-
-OFF-
AKD4516 Rev.A L1 SR
AKD4516 Rev.A L1 SILK



AKD4516 Rev.A L1

AK04516 Rev.A L2

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