AsahiKASEI MICRODEVICES

= Product Brief =

# AK4601

# Audio HUB CODEC with Digital Mixer

## 1. General Description

The AK4601 is an Audio HUB CODEC including 5ch ADC, 6ch DAC and digital mixers. The analog input block consists of a 24-bit stereo ADC with MIC gain amplifiers, a 24-bit stereo ADC with input selector and a monaural ADC, and the analog output block consists of 32-bit 6ch DAC. The transfer block for digital signals integrates serial interfaces that support TDM format and a Data BUS, realizing an audio HUB function. It gives scalability to the device for both analog and digital signals.
A car audio system that is capable of processing both sound and voice such as for hands-free function simultaneously can be realized by using the AK4601 with AKM's multi-core DSP, the AK7707. The AK4601 is available in a space saving 48-pin LQFP package.

## 2. Features

**□ ADC1: 24-bit Stereo ADC with MIC Gain Amplifiers**
- **Sampling Frequency: fs = 8 kHz to 192 kHz**
- **Channel Independent Analog Gain Amplifiers**
  **(0 to 18 dB / 2 dB Step, 18 to 36 dB / 3 dB step)**
- **Differential Input or Single-ended Input**
- **S/N: 106 dB (fs = 48 kHz, Differential Input, MIC Gain = 0 dB)**
- **Channel Independent Digital Volume Control**
  **(+24 dB to −103 dB / 0.5 dB Step and Mute)**
- **Digital HPF for DC Offset Cancelling**
- **2 outputs Low Noise MIC Bias Supply**
- **4 types of Digital Filter for Sound Color Selection**

**□ ADC2: 24-bit Stereo ADC with Input Selector**
- **Sampling Frequency: fs = 8 kHz to 192 kHz**
- **Analog Input Selector: Differential Input × 1 or Single-ended Input × 2, Semi-Differential Input × 1**
- **S/N: 106 dB (fs = 48 kHz, Differential Input)**
- **Channel Independent Digital Volume (+24 dB to −103 dB / 0.5 dB Step and Mute)**
- **Digital HPF for DC Offset Cancelling**
- **4 types of Selectable Digital Filters for Sound Color**

**□ ADCM: 24-bit Monaural ADC**
- **Sampling Frequency: fs = 8 kHz to 192 kHz**
- **Differential Input or Single-ended Input**
- **S/N: 106 dB (fs = 48 kHz, Differential Input)**
- **Digital Volume (+24 dB to −103 dB / 0.5 dB Step and Mute)**
- **Digital HPF for DC Offset Cancelling**
- **4 types of Selectable Digital Filters for Sound Color**

**□ DAC1–3: 32-bit Stereo DAC**
- **Sampling Frequency: fs = 8 kHz to 192 kHz**
- **Single-ended Output**
- **S/N: 108 dB (fs = 48 kHz)**
- **Channel Independent Digital Volume Control**
  **(+12 dB to −115 dB / 0.5 dB Step and Mute)**
- **4 types of Selectable Digital Filters for Sound Color**

**□ Serial IF: Audio Serial Interface:**
- **Support TDM and Stereo**
- **Data Input: max 20 ch (16 ch Serial × 1 pin, 2 ch × 2 pins) when TDM**
- **Data Output: max 20 ch (16 ch Serial × 1 pin, 2 ch × 2 pins) when TDM**
- **LRCK/BICK Input/Output x 2 Lines**
- **Data Format: MSB justified, LSB justified, $I^2S$**
- **PCM Short / Long Frame Supported**

**□ Mixer A, B: 2 stereo Input / 1 stereo Output Digital Mixer**
**□ Vol1–3: Channel Independent Stereo Digital Volume (+12 dB to −115 dB / 0.5 dB Step and Mute)**
**□ µP Interface:**
- **SPI (max. 7 MHz)**
- **$I^2C$-bus (max. 1 MHz: Fast Mode Plus, max.400 kHz: Fast mode)**

**□ Power Supply:**
- **Analog AVDD: 3.0 V to 3.6 V (typ. 3.3 V)**
- **Digital Core LVDD: 3.0 V to 3.6 V (typ. 3.3 V) (3.3 V → 1.2 V LDO integrated)**
- **Digital I/F TVDD: 1.7 V to 3.6 V (typ. 3.3 V)**

**□ Operating Temperature Range: −40 °C to 85 °C**
**□ Package: 48-pin LQFP (7 mm × 7 mm, 0.5 mm pitch)**

# 3. Block Diagram and Functions

## 3.1. Block Diagram

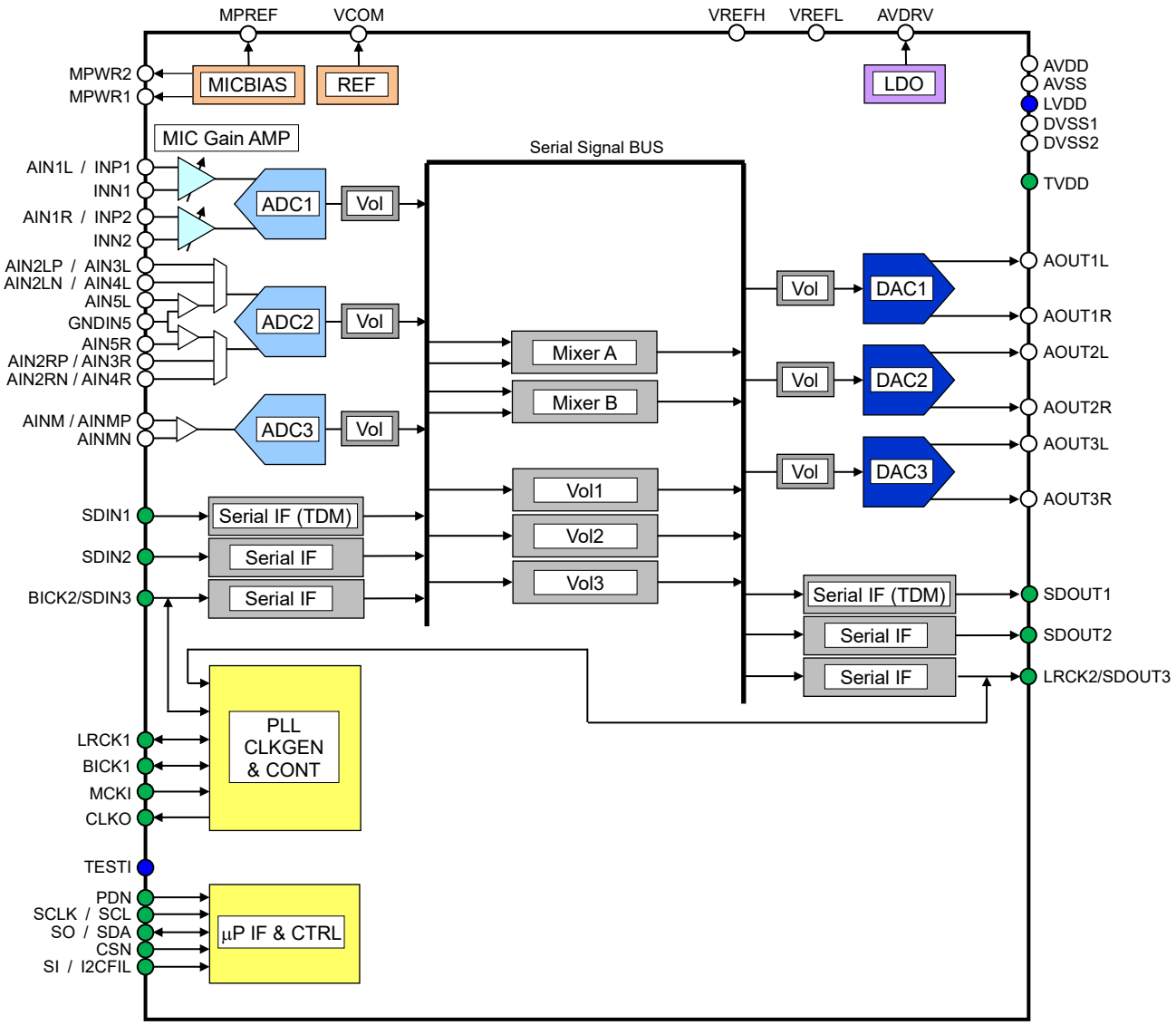



Figure 1. Block Diagram

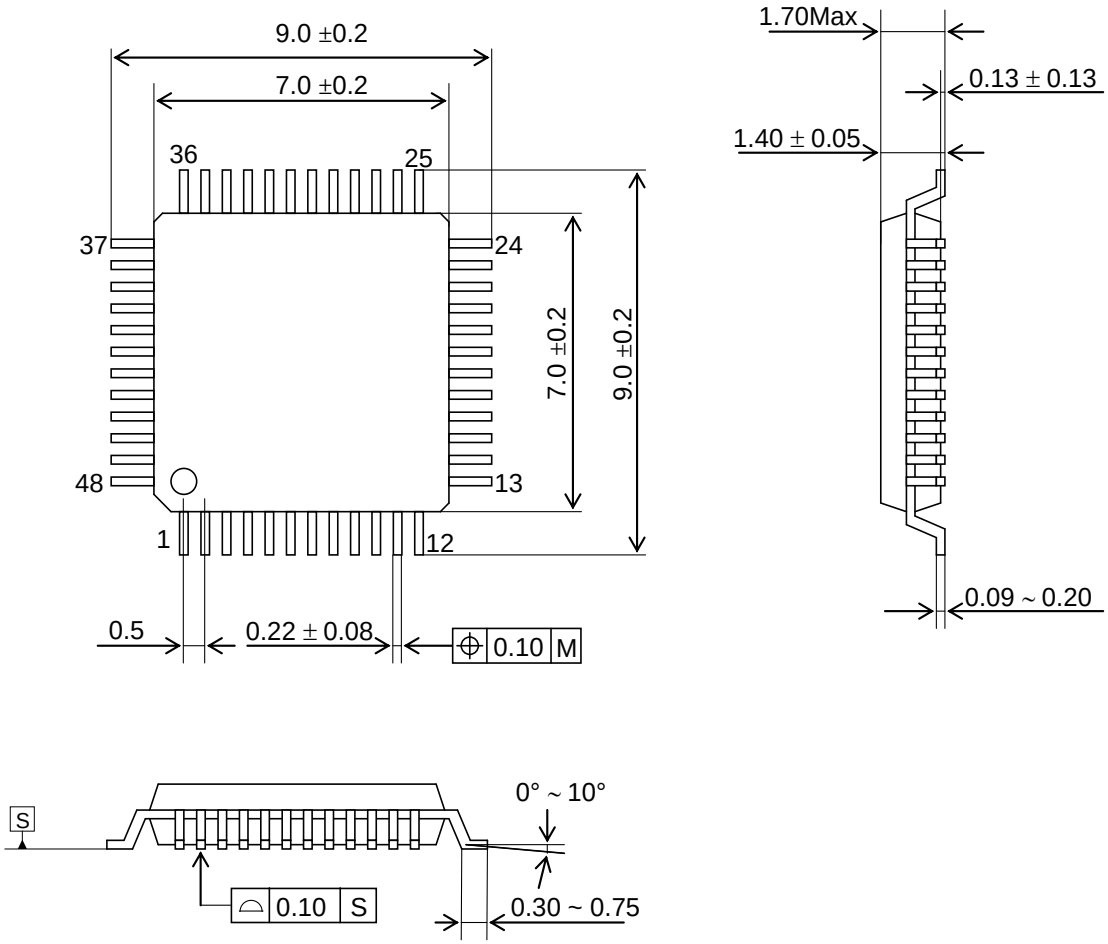
### 3.2. Functions

| Block | Function |
|---|---|
| REF | Generates internal reference voltage. |
| MICBIAS | Generates bias voltage for microphone. |
| MIC Gain AMP | Amplifies analog input signal. |
| ADC1, ADC2, ADCM | Convert analog signal to digital data. |
| Vol, Vol1-3 | Adjust the level of the digital audio signal. |
| Mixer A, Mixer B | Mix digital audio signals. |
| DAC1-3 | Convert digital data to analog signal. |
| LDO | Generates a power supply voltage of 1.2V (typ.) for internal logic circuits. |
| Serial IF | Communicate digital audio signals with external devices. |
| PLL, CLKGEN&CONT | Generates an internal operating clock based on the external clock. |
| μP IF&CTRL | SPI / $I^2C$ interface and control registers. |

## 4. Package

### 4.1. Outline Dimensions

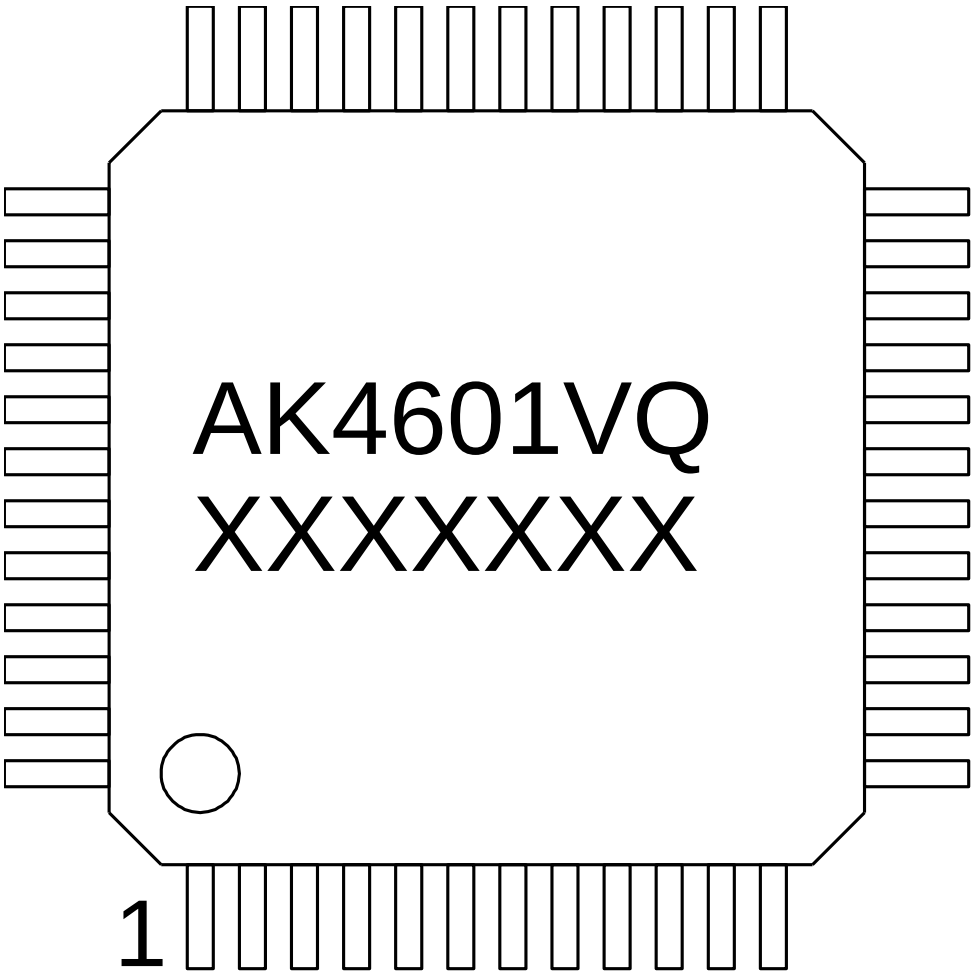
48pin LQFP(Unit: mm)




### 4.2. Material and Lead Finish

| | |
|---|---|
| Package: | Epoxy |
| Lead frame: | Copper |
| Pin surface treatment: | Soldering (Pb free) plate |

### 4.3. Marking




1) Pin #1 indication
2) Date Code: XXXXXXX (7 digits)
3) Marking Code: AK4601VQ
4) Asahi Kasei Logo

**IMPORTANT NOTICE**

0. Asahi Kasei Microdevices Corporation (“AKM”) reserves the right to make changes to the information contained in this document without notice. When you consider any use or application of AKM product stipulated in this document (“Product”), please make inquiries the sales office of AKM or authorized distributors as to current status of the Products.
1. All information included in this document are provided only to illustrate the operation and application examples of AKM Products. AKM neither makes warranties or representations with respect to the accuracy or completeness of the information contained in this document nor grants any license to any intellectual property rights or any other rights of AKM or any third party with respect to the information in this document. You are fully responsible for use of such information contained in this document in your product design or applications. AKM ASSUMES NO LIABILITY FOR ANY LOSSES INCURRED BY YOU OR THIRD PARTIES ARISING FROM THE USE OF SUCH INFORMATION IN YOUR PRODUCT DESIGN OR APPLICATIONS.
2. The Product is neither intended nor warranted for use in equipment or systems that require extraordinarily high levels of quality and/or reliability and/or a malfunction or failure of which may cause loss of human life, bodily injury, serious property damage or serious public impact, including but not limited to, equipment used in nuclear facilities, equipment used in the aerospace industry, medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, devices related to electric power, and equipment used in finance-related fields. Do not use Product for the above use unless specifically agreed by AKM in writing.
3. Though AKM works continually to improve the Product’s quality and reliability, you are responsible for complying with safety standards and for providing adequate designs and safeguards for your hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of the Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption.
4. Do not use or otherwise make available the Product or related technology or any information contained in this document for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). When exporting the Products or related technology or any information contained in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. The Products and related technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
5. Please contact AKM sales representative for details as to environmental matters such as the RoHS compatibility of the Product. Please use the Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. AKM assumes no liability for damages or losses occurring as a result of noncompliance with applicable laws and regulations.
6. Resale of the Product with provisions different from the statement and/or technical features set forth in this document shall immediately void any warranty granted by AKM for the Product and shall not create or extend in any manner whatsoever, any liability of AKM.
7. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of AKM.

# Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Asahi Kasei Microdevices:

AK4601VQ AK4602VQ