THE DATASHEET OF

AK2360A

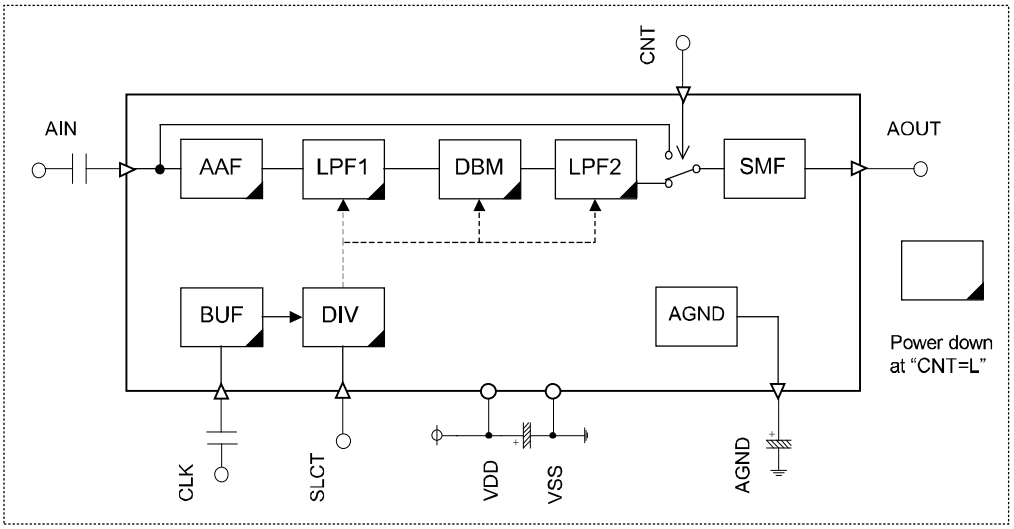
AK2360A

Scrambler IC for two-way radio

Features

- Frequency inversion type scrambler for a voice encryption two-way radio
- High quality decoded voice: S/N=47dB(Typ), S/(N+D)=50dB(Typ)
- Allowing selection of an inverted frequency (3.397kHz or 3.039kHz) and voice passage band
- Scrambler bypass function included
- Based on 5.3125MHz (1/4 for 21.25MHz) external clock supply
- Operating voltage: 2.6V to 3.3V
- Operating temperature: -30°C to +85°C
- Package: 8-pin SON

Block Diagram



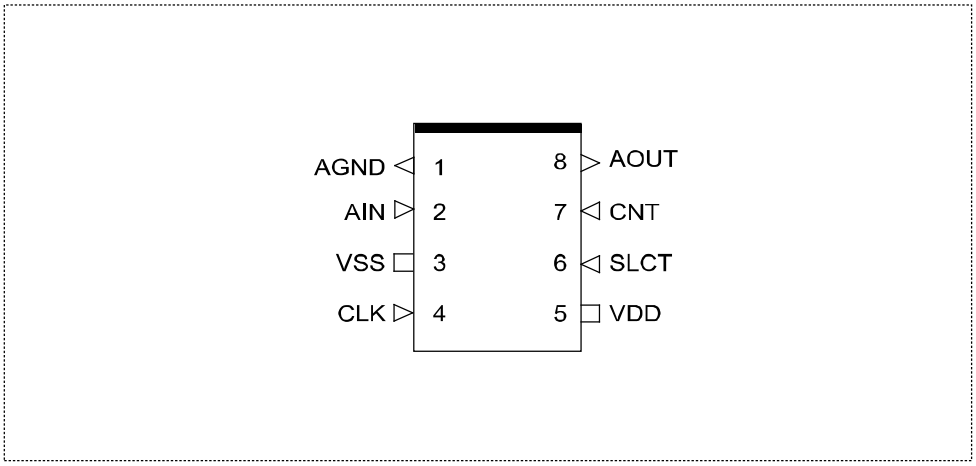
Contents

- Features 1
- Block Diagram 1
- Contents 2
- General Description 3
- Circuit Configuration 3
- Pin Functions 4
- Absolute Maximum Ratings 5
- Recommended Operating Conditions 5
- Digital DC Characteristics 5
- Clock Input Characteristics 5
- Current Consumption 6
- Analog Characteristics 6
- Recommended External Application Circuits 7
- Package 9

General Description

The AK2360A is a radio scrambler IC device suitable for half-duplex communication. As the scrambler method, a simple frequency inversion method is used in which audio signal components are inverted about the carrier frequency by using the double balanced mixer (DBM).
The inverted frequency and voice passage band can be changed according to the input to the SLCT pin. The scrambler can be bypassed by using the CNT pin, and part of the circuit blocks is placed in the power-down state accordingly.
A signal-to-noise ratio of 40dB or more and a distortion of 43dB or more can be obtained by inserting filters before and after DBM as shown in the block diagram, therefore allowing less sound quality deterioration when the scrambler is used.

☐ Pin assignments (Top view)



Circuit Configuration

Block	Function
AAF	Active low-pass filter to prevent aliasing noise generated in the following switched capacitor filter (SCF) block
LPF1	Low-pass filter for limiting the band of the audio signal input from the AIN pin
DBM	Double balanced modulator for performing frequency inversion. The carrier frequency can be changed according to the input level on the SLCT pin.
LPF2	Low-pass filter for removing upper wave components generated by mixing by DBM
SMF	Smoothing filter for removing harmonics components generated in LPF2 and clock components
BUF	Buffer circuit for adjusting the level of the clock signal input from the CLK pin
DIV	Divides the clock signal and generates a clock signal for the SCF circuit and the carrier frequency for DBM.
AGND	A block for generating the reference voltage (1/2VDD) of the internal analog circuit

Pin Functions

Pin No.	Pin name	Pin type	Function
1	AGND	AO	Analog ground output pin A capacitor is connected to this pin to stabilize the analog ground level.
2	AIN	AI	Audio signal input pin
3	VSS	PWR	Negative power supply pin Apply 0V.
4	CLK	AI	Clock signal input pin See "Recommended External Application Circuits".
5	VDD	PWR	Positive power supply pin Connect this pin to a power supply ranging from 2.6V to 3.3V with less noise. Connect a bypass capacitor of 0.1μF or higher between this pin and the VSS pin.
6	SLCT	DI	Carrier frequency switching pin This pin changes the carrier frequency and voice passage band for the scrambler. Input level / Carrier frequency / Voice passage band High / 3.376kHz / 290Hz to 3090Hz Low / 3.020kHz / 260Hz to 2760Hz *1)
7	CNT	DI	Scrambler bypass pin This pin causes the AAF block through LPF2 block to be bypassed. When bypassed, these blocks are placed in the power-down state. Input level / Setting High / Scrambler enables. Low / Scrambler bypasses. *1)
8	AOUT	AO	Audio signal output pin *2)

Note) **A**: Analog, **D**: Digital, **PWR**: Power, **I**: Input, **O**: Output

*1) A pull-up resistor of 50kΩ or more is included.
*2) Load impedance > 10kΩ, load capacitance < 50pF

Absolute Maximum Ratings

Parameter	Symbol	Min.	Max.	Unit
Power supply voltage	VDD	-0.3	4.6	V
Ground level	VSS	0	0	V
Input voltage	V_{IN}	-0.3	VDD+0.3	V
Input current (excluding power supply pin)	I_{IN}	-10	+10	mA
Storage temperature	T_{stg}	-55	130	°C

Note) All voltages are relative to the VSS pin.

Caution) If the device is used in conditions exceeding these values, the device may be destroyed. Normal operations are not guaranteed in such extreme conditions.

Recommended Operating Conditions

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Operating temperature	Ta		-30		85	°C
Operating power supply voltage	VDD		2.6	3.0	3.3	V
Analog reference voltage	AGND			1/2VDD		V

Note) All voltages are relative to the VSS pin.

Digital DC Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
High level input voltage	V_{IH}	SLCT, CNT	0.8VDD			V
Low level input voltage	V_{IL}	SLCT, CNT			0.2VDD	V
High level input current	I_{IH}	V_{IH}=VDD SLCT, CNT			10	µA
Low level input current	I_{IL}	V_{IL}=0V SLCT, CNT	-66			µA
Pull-up resistance	R_{UP}	SLCT, CNT	50			kΩ

Clock Input Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	Remarks
Clock cycle	T_{WP}	CLK		188		ns	f=5.3125MHz
Input amplitude	V_{CLK}	CLK	0.2		VDD-0.1	V_{PP}	Clipped sine wave

Current Consumption

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Current consumption	IDD0	When scrambler is bypassed (CNT=V_{IL}) with CLK=5.3125MHz, V_{CLK}=0.2Vpp		0.7	1.1	mA
	IDD1	When scrambler is operating (CNT=V_{IH}) with CLK=5.3125MHz, V_{CLK}=0.2Vpp		1.65	2.6	

Analog Characteristics

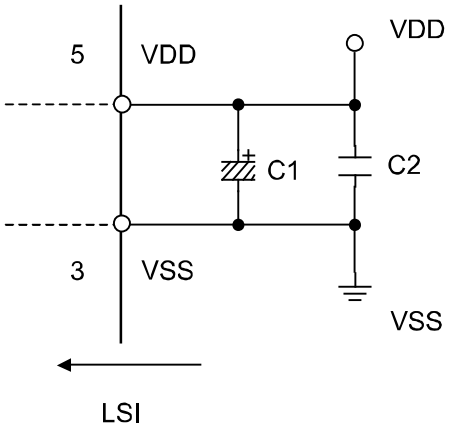
Unless otherwise specified, the following apply: CLK = 5.3125MHz, SLCT = V_{IH}, CNT = V_{IH}, f = 1kHz@AIN, dBm = 0dBm (= 0.775Vrms) at 1mW with a 600Ω load.

Parameter	Condition	Min.	Typ.	Max.	Unit	Remarks
Standard input level	@AIN		-11.5		dBm	
Output level	AIN to AOUT AIN=-11.5dBm When CNT=V_{IH}: (3.397-1.0)kHz When CNT=V_{IL}: 1.0kHz	-12.5	-11.5	-10.5	dBm	
S/N ratio	AIN to AOUT AIN=-11.5dBm When CNT=V_{IH} and CNT=V_{IL}: 30kHz low-pass filtering	40	47		dB	
S/(N+D)	AIN to AOUT AIN=-2.7dBm When CNT=V_{IH} and CNT=V_{IL}: 30kHz low-pass filtering	43	50		dB	
High frequency rejection level	AIN to AOUT AIN=-11.5dBm Measurement frequency:(3.397+1.0)kHz		-65	-51.5	dBm	
Carrier signal leakage level	AIN to AOUT AIN=No input Measurement frequency: 3.397kHz		-75	-51.5	dBm	
Original signal leakage level	AIN to AOUT AIN=-11.5dBm Measurement frequency: 1.0kHz		-85	-51.5	dBm	

Note) Under connecting 10kΩ and 50pF load to AGND(=1/2VDD) equivalent offset level AOUT pin.

Recommended External Application Circuits

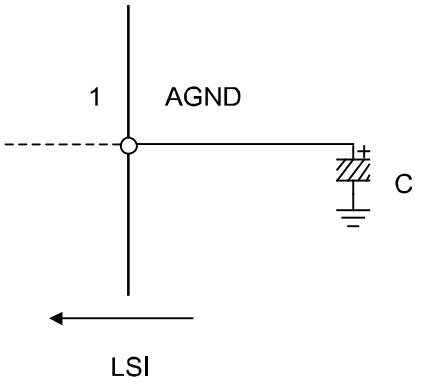
1) Power supply stabilizing capacitance
Connect capacitors between the VDD and VSS pins to eliminate ripple and noise included in power supply. For maximum effect, the capacitors should be placed at a shortest distance between the pins.



C1 = 22μF (Electrolytic cap)

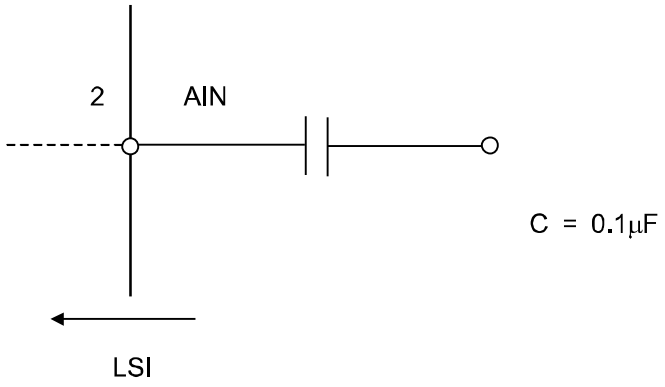
C2 = 0.1μF (Ceramic cap)

2) AGND stabilizing capacitance
It is recommended that a capacitor with 1.0μF or larger be connected between the AGND pin and VSS to stabilize the AGND signal. The capacitor should be placed as close to the AGND pin as possible.

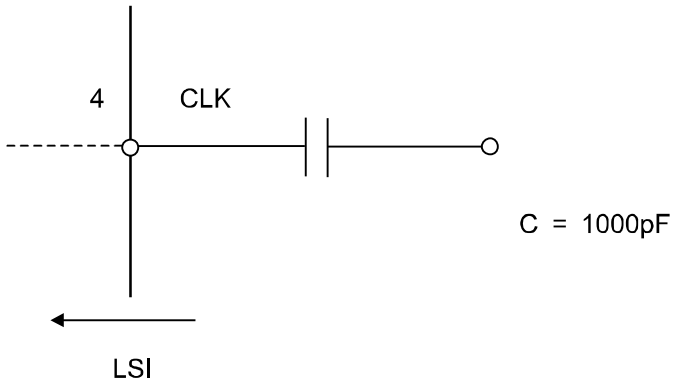


C = 1.0μF (Electrolytic cap)

3) External AIN capacitance
Connect a capacitor to the AIN pin to adjust the input signal DC offset and the internal operation point of the LSI device. This configures a high-pass filter with fc being about 3Hz.

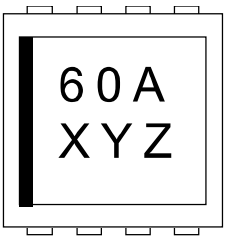


4) External CLK capacitance
Connect a capacitor to the CLK pin to adjust the DC offset of the clipped sine signal and the internal operation point of the LSI device.



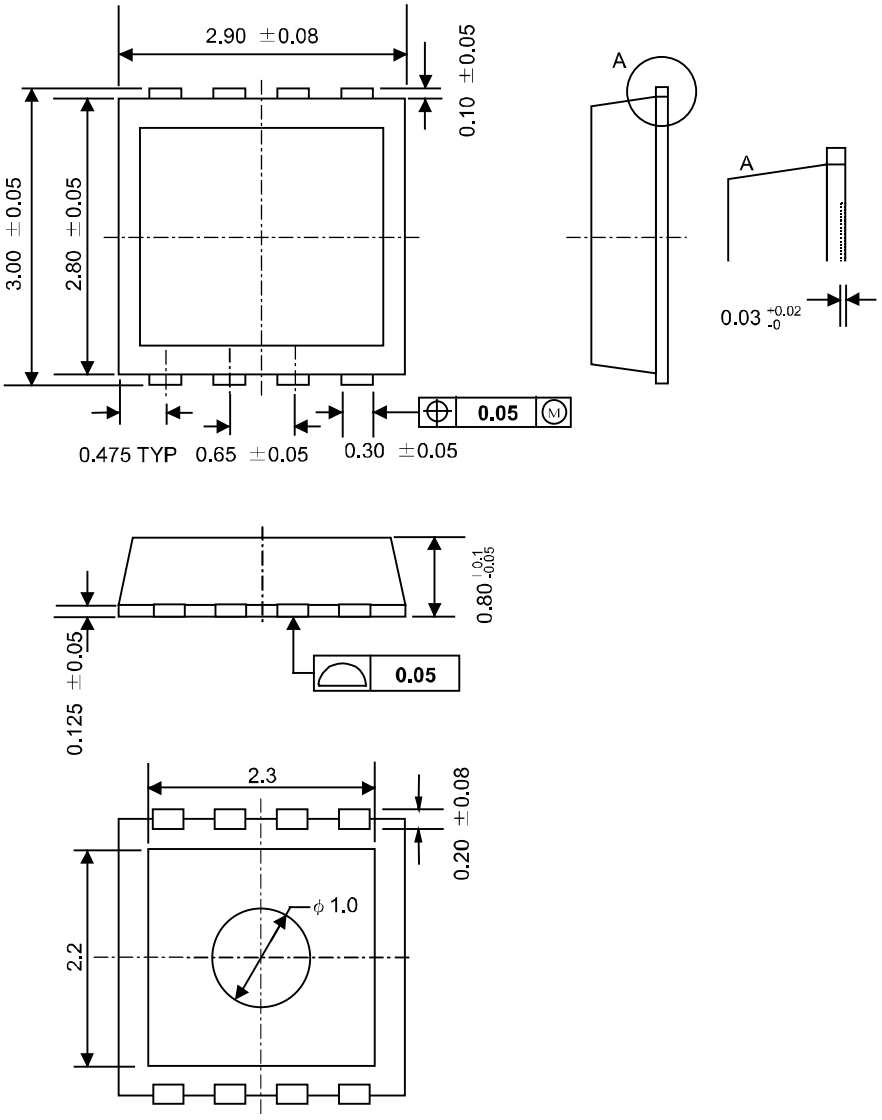
Package

☐ Marking



X: Date of manufacturing Lowest 1 digit of the year
Y: Date of manufacturing Month
Z: Production lot number

☐ Outline dimensions



IMPORTANT NOTICE

- These products and their specifications are subject to change without notice. Before considering any use or application, consult the Asahi Kasei Microsystems Co., Ltd. (AKM) sales office or authorized distributor concerning their current status.
- AKM assumes no liability for infringement of any patent, intellectual property, or other right in the application or use of any information contained herein.
- Any export of these products, or devices or systems containing them, may require an export license or other official approval under the law and regulations of the country of export pertaining to customs and tariffs, currency exchange, or strategic materials.
- AKM products are neither intended nor authorized for use as critical components in any safety, life support, or other hazard related device or system, and AKM assumes no responsibility relating to any such use, except with the express written consent of the Representative Director of AKM. As used here:
  (a) A hazard related device or system is one designed or intended for life support or maintenance of safety or for applications in medicine, aerospace, nuclear energy, or other fields, in which its failure to function or perform may reasonably be expected to result in loss of life or in significant injury or damage to person or property.
  (b) A critical component is one whose failure to function or perform may reasonably be expected to result, whether directly or indirectly, in the loss of the safety or effectiveness of the device or system containing it, and which must therefore meet very high standards of performance and reliability.
- It is the responsibility of the buyer or distributor of an AKM product who distributes, disposes of, or otherwise places the product with a third party to notify that party in advance of the above content and conditions, and the buyer or distributor agrees to assume any and all responsibility and liability for and hold AKM harmless from any and all claims arising from the use of said product in the absence of such notification.

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

- View AK2360A on WIN SOURCE
- Asahi Kasei Microsystems Information

Optimize Your Supply Chain with WIN SOURCE Solutions

- Global Sourcing Solution
- Obsolete Management
- Cost Control Management
- Shortage Management
- Alternative Solution
- Excess Inventory Management