



# Spread Spectrum Clock Generator

## AK8126

### Features

- **Output Frequency Range:**  
16MHz – 128MHz
- **Configurable Spread Spectrum Modulation:**
  - AKEMD's Original Spread Spectrum Profile
  - **Modulation Ratio:**
    - Center Spread:**  
 $\pm 0.25\%$ ,  $\pm 0.5\%$ ,  $\pm 1.0\%$ ,  $\pm 1.5\%$
    - Down Spread:**  
 $-0.5\%$ ,  $-1.0\%$ ,  $-2.0\%$ ,  $-3.0\%$
  - **Modulation Frequency:**  
38.46KHz – 76.92KHz
- **Input Frequency Range:**
  - Crystal: 16MHz – 32MHz
  - Reference Clock Input : 16MHz – 128MHz
- **Low Jitter Performance:**  
100 ps (Max.) Cycle-to-cycle  $1\sigma$
- **Low Current Consumption:**  
2.5mA (Typ.) at 16MHz, 3.3V
- **Supply Voltage:**  
3.0 – 3.6V
- **Operating Temperature Range:**  
-10 to +85
- **Package:**  
10-pin TMSOP (Thin Miniature SOP )

### Description

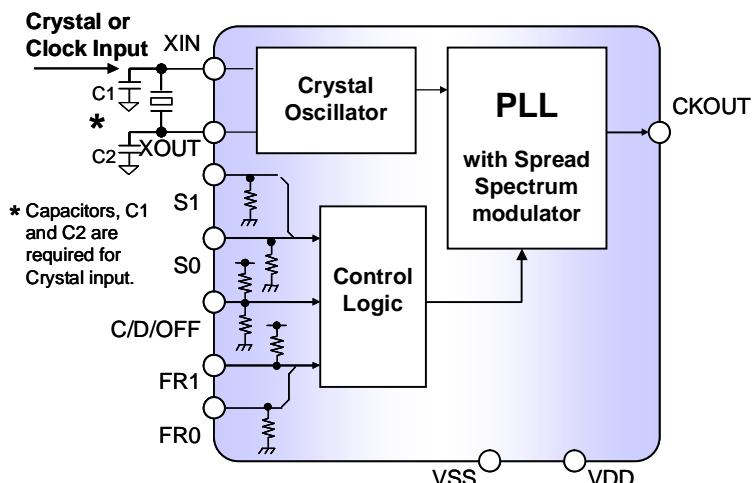
The AK8126 is a spread spectrum clock generator designed for Home AV applications where EMI elimination is seriously required. The device uses the AKEMD's original spread spectrum profile\*\* to provide excellent EMI reduction effect without degradation of system performance. The AK8126 accepts a wide clock frequency range from a crystal or reference clock input, and provides a variable spread spectrum modulation selectable by pin-setting, allowing the device to use in most AV products easily. The device is available in a very small 10-pin TMSOP package, and its pin configuration offers simple PCB layout.

\*\*: Patent pending

### Applications

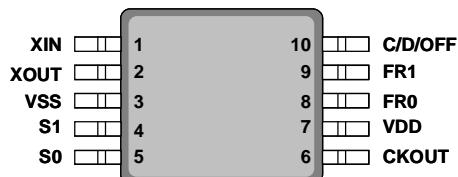
- Digital TV Sets
- Display Panels
- Personal Video Recorders
- Set-Top-Boxes
- Multi Media Receivers

### Block Diagram



AK8126 Spread Spectrum Clock Generator

## Pin Descriptions



Package: 10-Pin TMSOP (Top View)

Pin No.	Pin Name	Pin Type	Description
1	XIN	IN	Crystal Input or Reference Clock Input
2	XOUT	OUT	Crystal Output. Leave this pin floating when the external clock is used.
3	VSS	--	Ground
4	S1	IN	Spread Spectrum Modulation Ratio Select Pin1 (1)
5	S0	IN	Spread Spectrum Modulation Ratio Select Pin0 (1)
6	CKOUT	OUT	Clock Output
7	VDD	--	Power Supply
8	FR0	IN	Clock Frequency Range Select Pin 0 (2)
9	FR1	IN	Clock Frequency Range Select Pin 1 (1)
10	C/D/OFF	IN	Spread Spectrum Modulation Mode Select Pin (3)

(1) Internal pull down 360kΩ (Typ.)

(2) Internal pull up 360kΩ (Typ.)

(3) 3-Level Input for Low/Mid/Hi. Biased at 1/2 of VDD with pull-up/down resistors of 360kΩ (Typ.).

## Ordering Information

Part Number	Marking	Shipping Packaging	Package	Temperature Range
AK8126	8126	Tape and Reel	10-pin TMSOP	-10 to 85

## Absolute Maximum Rating

Over operating free-air temperature range unless otherwise noted <sup>(1)</sup>

Items	Symbol	Ratings	Unit
Supply Voltage	VDD	-0.3 to 4.6	V
Input Voltage	Vin	VSS-0.3 to VDD+0.3	V
Input Current (any pins except supplies)	I <sub>IN</sub>	±10	mA
Storage Temperature	T <sub>STG</sub>	-55 to 130	°C

Note

(1) Stress beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only. Functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" is not implied. Exposure to absolute-maximum-rating conditions for extended periods may affect device reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.



## ESD Sensitive Device

This device is manufactured on a CMOS process, therefore, generically susceptible to damage by excessive static voltage. Failure to observe proper handling and installation procedures can cause damage. AKEMD recommends that this device is handled with appropriate precautions.

## Recommended Operation Conditions

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating Temperature	T <sub>a</sub>		-10		85	°C
Supply Voltage	VDD		3.0	3.3	3.6	V
Input Clock Frequency <sup>(1)</sup>	Fin 1	Crystal	16	24	32	MHz
	Fin 2	External Reference Clock Input	16		128	MHz
Output Load Capacitance	C <sub>p1</sub>	Output Frequency 16 – 67MHz			15	pF
		Output Frequency 67 – 100MHz			10	pF
		Output Frequency 100 – 128MHz			8	pF

Note:

(1) Frequency range to operate is required to select by pin-setting of S0 (Pin 5) and S1 (Pin 4). See Table for the frequency range selection.

## DC Characteristics

All specifications at VDD: over 3.0 to 3.6V, Ta: -10 to +85°C, Input Frequency: over 16MHz to 128MHz, unless otherwise noted

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
High Level Input Voltage 1	$V_{IH}$ 1	Pin: S0,S1,FR0, FR1	0.8VDD			V
Low Level Input Voltage 1	$V_{IL}$ 1	Pin: S0,S1,FR0, FR1			0.2VDD	V
High Level Input Voltage 2	$V_{IH}$ 2	Pin: C/D/OFF	0.8VDD			V
Low Level Input Voltage 2	$V_{IL}$ 2	Pin: C/D/OFF			0.15VDD	V
Mid Level Input Voltage 2	$V_{IM}$ 2	Pin: C/D/OFF	0.45VDD	0.50VDD	0.55VDD	V
High Level Input Voltage 3	$V_{IH}$ 3	Pin: XIN	0.8VDD			V
Low Level Input Voltage 3	$V_{IL}$ 3	Pin: XIN			0.2VDD	V
Input Current	$I_L$	Pin: S0, S1, FR0, FR1, C/D/OFF	-20		+20	$\mu$ A
High Level Output Voltage	$V_{OH}$	Pin: CLKOUT $I_{OH}=-4mA$	0.8VDD			V
Low Level Output Voltage	$V_{OL}$	Pin: CLKOUT $I_{OL}=+4mA$			0.2VDD	V
Current Consumption	$I_{DD}$	No load, Ta=25°C Spread Spectrum Mode selection by note <sup>(2)</sup>		2.5		mA

(2) In the mode of center spread

## AC Characteristics

All specifications at VDD: over 3.0 to 3.6V, Ta: -10 to +85°C, Input Frequency: over 16MHz to 128MHz, unless otherwise noted

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Output Clock Duty Cycle <sup>(4)</sup>			40	50	60	%
Output Clock Rise Time <sup>(4)</sup>	$t_{rise}$			1.2		ns
Output Clock Fall Time <sup>(4)</sup>	$t_{fall}$			1.2		ns
Output Clock Jitter	Jit 1	Cycle-to-cycle $1\sigma, 1x$			100	ps
	Jit 2	Cycle-to-cycle Peak-to-peak, 1x			600	ps
Output Lock Time <sup>(3)</sup>	$t_{lock}$	Power-up		5		ms

(3) The time that output reaches the target frequency within accuracy of  $\pm 0.1\%$  from the point that the power supply reaches VDD

(4) With the load capacitance specified by the recommended operation conditions

## Spread Spectrum Modulation Characteristics

All specifications at VDD: over 3.0 to 3.6V, Ta: -10 to +85°C, Input Frequency: over 16MHz to 128MHz, unless otherwise noted

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Modulation Frequency <sup>(5)</sup>	$f_{mod}$		38.46		76.92	kHz
Modulation Ratio @ Center Spread	Mod C	Ratio Selection Pin S[1:0]=LH		$\pm 0.25$		%
		Ratio Selection Pin S[1:0]=LL		$\pm 0.5$		
		Ratio Selection Pin S[1:0]=HL		$\pm 1.0$		
		Ratio Selection Pin S[1:0]=HH		$\pm 1.5$		
Modulation Ratio @ Down Spread	Mod D	Ratio Selection Pin S[1:0]=LH		-0.5		%
		Ratio Selection Pin S[1:0]=LL		-1.0		
		Ratio Selection Pin S[1:0]=HL		-2.0		
		Ratio Selection Pin S[1:0]=HH		-3.0		
Average Modulation Frequency Offset <sup>(6)</sup> @ Down Spread	$f_{mod-off}$	Ratio Selection Pin S[1:0]=LH		-0.36		%
		Ratio Selection Pin S[1:0]=LL		-0.6		
		Ratio Selection Pin S[1:0]=HL		-1.2		
		Ratio Selection Pin S[1:0]=HH		-1.8		

(5) Modulation frequency is determined by input frequency range. Following equations provide the theoretical modulation frequency of AK8126.

$$\text{Output Frequency Range 16-32MHz: } f_{mod}(\text{KHz}) = 38.46\text{KHz} \times f_{in}(\text{MHz}) / 16\text{MHz}$$

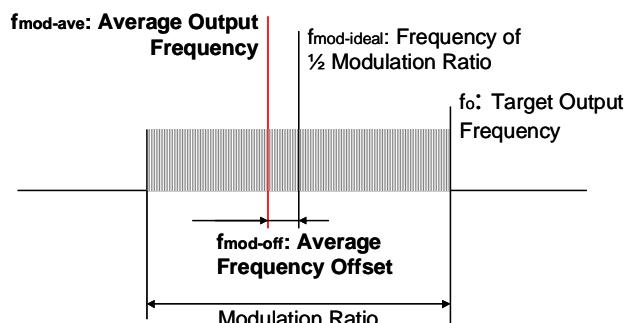
$$32-64\text{MHz: } f_{mod}(\text{KHz}) = 38.46\text{KHz} \times f_{in}(\text{MHz}) / 32\text{MHz}$$

$$64-128\text{MHz: } f_{mod}(\text{KHz}) = 38.46\text{KHz} \times f_{in}(\text{MHz}) / 64\text{MHz}$$

$$64-128\text{MHz, x4 Output mode: } f_{mod}(\text{KHz}) = 38.46\text{KHz} \times f_{in}(\text{MHz}) / 16\text{MHz}$$

Where,  $f_{in}$  is an input frequency of crystal or reference clock input.

(6) The average output frequency in the mode of down spread modulation is intentionally offset against the ideal average frequency. The offset is specified by percentage to the target output frequency as shown in **Figure 1**.



**Figure 1: Offset in the mode of down spread modulation**

## Operation Clock Frequency Range Selection

The AK8126 operates at a wide frequency range to support clocking in most of Home AV products. The operation frequency range applying to the AK8126 is required to select by pin-setting of FR0 (Pin8) and FR1 (Pin9), as shown in **Table 1**.

**Table 1: Operation Clock Frequency Setting**

Pin Setting		Input Frequency (MHz)	Output Frequency (MHz)	Input Frequency Scaling	Applicable Input	
FR1	FR0				Crystal	Clock
L	L	16 – 32	16 – 32	x 1	✓	✓
L	H	32 – 64	32 – 64			✓
H	L	64 – 128	64 – 128			✓
H	H	16 – 32	64 – 128	x4	✓	✓

## Spread Spectrum Modulation Selection

The AK8126 operates in two modes of spread spectrum modulation. One is “Center Spread Modulation” in which the frequency deviation from the target output frequency is equal to the lower side and the upper side. The other one is “Down Spread Modulation”, which will be used in applications where the target clock is providing at a maximum frequency rate of that system. In this mode, the maximum spread frequency is equal to the target frequency, and the frequency deviation is provided in the lower side. The AK8126 can provide a variable modulation ratio with the AKEMD's original spread profile for both modulation modes, offering appropriate tune for EMI elimination without degradation of system performance.

The modulation mode and the modulation ration are selectable by pin setting of C/D/OFF (Pin 10) and S[1:0] (Pin 4 and 5), as defined in **Table 2** and **Table 3**, respectively.

**Table 2: Spread Spectrum Modulation Mode Setting**

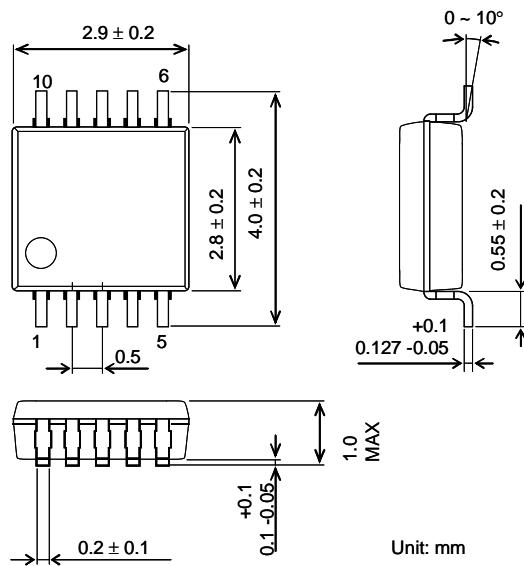
Pin Setting C/D/OFF	Modulation Mode	
L	Down Spread	
M	No Modulation	
H	Center Spread	

**Table 3: Modulation Ratio Setting**

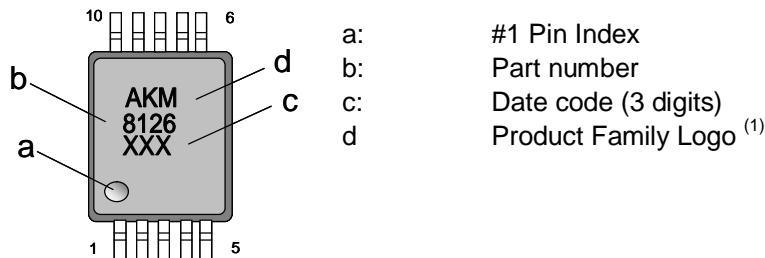
Pin Setting	S1	S0	Modulation Ratio (%)	
			Center Spread Mode	Down Spread Mode
L	L		± 0.5	-1.0
L	H		± 0.25	- 0.5
H	L		± 1.0	-2.0
H	H		± 1.5	- 3.0

## Package Information

- **Mechanical data**



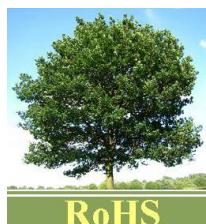
- **Marking**



(1) **AKM** is the brand name of AKEMD's IC's.

**AKM** and the logo -  - are the brand of AKEMD's IC's and identify that AKEMD continues to offer the best choice for high performance mixed-signal solution under this brand.

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(\* ) RoHS compliant products from AKEMD are identified with "Pb free" letter indication on product label posted on the anti-shield bag and boxes.

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