



Low power Multiclock Generator with VCXO AK8138C

Features

- 27MHz Crystal Input
- Four Frequency-Selectable Clock Outputs
- One 27MHz-Reference Output
- Selectable Clock out Frequencies:
 - 74.1758, 74.250MHz
 - 25.000MHz
 - 4.9152, 12.000, 24.000, 24.576MHz
 - 33.333MHz
- Built-in VCXO
 - Pull Range: ± 110 ppm (Min.)
- Low Jitter Performance
 - Period Jitter: 150 psec (Typ.) at CLK1-4
 - Long Term Jitter : 0.85ns (Typ.) 74.1758MHz
160 psec (Typ.) at REFOUT
- Low Current Consumption: 16.5mA (Typ.) at 3.3V
- Supply Voltage: 3.0 – 3.6V
- Operating Temperature Range: -20 to +85°C
- Package: 16-pin SSOP (Lead free)

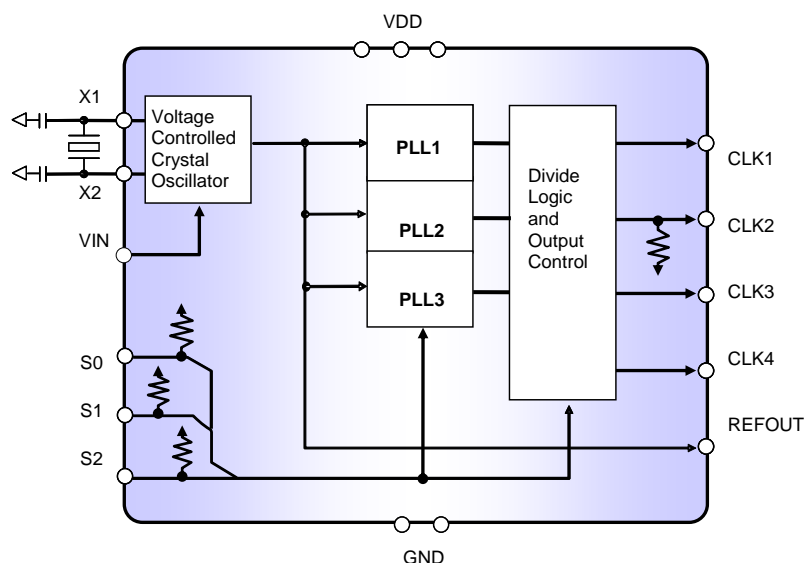
Description

The AK8138C is a member of AKM's low power multi clock generator family designed for a feature rich DTV or STB, requiring a range of system clocks with high performance. The AK8138C generates different frequency clocks from a 27MHz crystal oscillator and provides them to up to four outputs configured by pin-setting. The on-chip VCXO accepts a voltage control input to allow the output clocks to vary by ± 110 ppm for synchronizing to the external clock system. Both circuitries of VCXO and PLL in AK8138C are derived from AKM's long-term-experienced clock device technology, and enable clock output to perform low jitter and to operate with very low current consumption. The AK8138C is available in a 16-pin SSOP package.

Applications

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

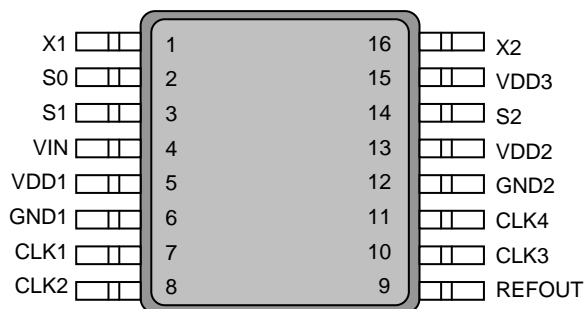
Block Diagram



AK8138C Multi Clock Generator

Pin Descriptions

Package: 16-Pin SSOP(Top View)



Pin No.	Pin Name	Pin Type	Description
1	X1	XO	Crystal connection, Connect to 27.000MHz crystal Please open when an external clock input is used
2	S0	IN	Clock Out Frequency Select 0, See Table 1 for the selection (1)
3	S1	IN	Clock Out Frequency select 1, See Table 1 for the selection (1)
4	VIN	IN	VCXO Control Voltage Input
5	VDD1	--	Power Supply 1
6	GND1	--	Ground 1
7	CLK1	OUT	Clock output 1, See Table 1 for its selectable frequency
8	CLK2	OUT	Clock output 2, See Table 1 for its selectable frequency (2)
9	REF OUT	OUT	Reference Clock Output of VCXO based on 27.000MHz Crystal
10	CLK3	OUT	Clock output 3, See Table 1 for its selectable frequency
11	CLK4	OUT	Clock output 4, See Table 1 for its selectable frequency
12	GND2	--	Ground 2
13	VDD2	--	Power Supply 2
14	S2	IN	Clock Out Frequency select 1, See Table 1 for the selection (1)
15	VDD3	--	Power Supply 3
16	X2	XI	Crystal connection, Connect to 27.000MHz crystal Or external clock input (minimum 1Vpp input).

(1) Internal pull up 360k Ω

(2) Internal pull down 510k Ω

Ordering Information

Part Number	Marking	Shipping Packaging	Package	Temperature Range
AK8138C	8138C	Tape and Reel	16-pin SSOP	-20 to 85 °C

Absolute Maximum Rating

Over operating free-air temperature range unless otherwise noted ⁽¹⁾

Items	Symbol	Ratings	Unit
Supply voltage	VDD	-0.3 to 4.6	V
Input voltage	V _{in}	VSS-0.3 to VDD+0.3	V
Input current (any pins except supplies)	I _{IN}	±10	mA
Storage temperature	T _{stg}	-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. AKM recommends that this device is handled with appropriate precautions.

Recommended Operation Conditions

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Operating temperature	T _a		-20		85	°C
Supply voltage ⁽¹⁾	VDD		3.0	3.3	3.6	V
Output Load Capacitance	C _{p1}	Pin: CLK1-4			15	pF
	C _{p2}	Pin: REFOUT			25	pF

Note:

(1) Power to VDD1, VDD2 and VDD3 requires to be supplied from a single source. A decoupling capacitor of 0.1μF for power supply line should be installed close to each VDD pin.

DC Characteristics

All specifications at VDD: over 3.0 to 3.6V, Ta: -20 to +85°C, 27MHz Crystal, unless otherwise noted

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
High Level Input Voltage	V_{IH}	Pin: S0,S1,S2	0.7VDD			V
Low Level Input Voltage	V_{IL}	Pin: S0,S1,S2			0.3VDD	V
Input Current 1	I_{L1}	Pin: S0,S1,S2	-20		+10	μA
Input Current 2	I_{L2}	PIN: VIN	-3		+3	μA
High Level Output Voltage	V_{OH}	Pin: CLK1-4, REFOUT $I_{OH}=-4mA$	0.8VDD			V
Low level Output Voltage	V_{OL}	Pin: CLK1-4, REFOUT $I_{OL}=+4mA$			0.2VDD	V
Current Consumption	I_{DD}	No load Clock out selection by note ⁽¹⁾ Ta=25°C		16.5		mA

(1) Pin setting for output clock selection: [S2:S0] = HLH

AC Characteristics

All specifications at VDD: over 3.0 to 3.6V, Ta: over -20 to +85°C, 27MHz Crystal, unless otherwise noted

Parameter	Symbol	Conditions	MIN	TYP	MAX	Unit
Crystal Clock Frequency				27.0000		MHz
VCXO Pullable Range ⁽³⁾		VIN at over 0 to VDD V	± 110			ppm
VCXO Gain	G_{VCXO}	VIN range at 1.5V \pm 1.0V		150		ppm/V
Period Jitter ⁽⁴⁾		CLK1-4		150		ps
Long Term Jitter ⁽⁵⁾		CLK1 at 74.1758MHz 1000 cycle delay		0.85		ns
		REFOUT at 27.000MHz 1000 cycle delay		160		ps
Output Clock Duty Cycle		Pin: CLK1-4 ⁽¹⁾	45	50	55	%
		Pin: REFOUT ⁽²⁾	40	50	60	%
Output Clock Rise Time	t_{rise}	Pin: CLK1-4 ⁽¹⁾		1.5	4	ns
		Pin: REFOUT ⁽²⁾		2.5	4	ns
Output Clock Fall Time	t_{fall}	Pin: CLK1-4 ⁽¹⁾		1.5	4	ns
		Pin: REFOUT ⁽²⁾		2.5	4	ns
Power-up Time		Pin: CLK1-4 ⁽¹⁾		1	2	ms
Output Transition Time ⁽⁶⁾		Pin: CLK1 at 74.25 or 74.175MHz		90	140	μs

(1) Measured with load capacitance of 15pF

(2) Measured with load capacitance of 25pF

(3) Pullable range depends on crystal characteristics, on-chip load capacitance, and stray capacity of PCB.
Min. ± 110 ppm is applied to AKM's authorized test condition.

(4) $\pm 3\sigma$ in 10000 sampling or more

(5) $\pm 3\sigma$ in 5000 sampling or more

(6) Time to settle output into ± 20 ppm of specified frequency

Output clock frequency selection

The AK8138C generates a range of low-jitter and hi-accuracy clock frequencies with three built-in PLLs and provides up to four assigned outputs. A frequency selection at assigned output pin is configured by pin-setting of S0 (Pin2), S1 (Pin3), and S2 (Pin14).

The selectable frequency is shown in **Table 1**.

Table 1: Clock output Frequency

Selection Pin			Clock Output Frequency (MHz)			
S2 (Pin 14)	S1 (Pin 3)	S0 (Pin 2)	CLK1 (Pin 7)	CLK2 (Pin 8)	CLK3 (Pin 10)	CLK4 (Pin 11)
L	L	L	74.250	25.000	24.000	33.333
L	L	H	74.250	25.000	12.000	33.333
L	H	L	74.1758	25.000	24.000	33.333
L	H	H	74.1758	25.000	12.000	33.333
H	L	L	74.250	25.000	24.576	33.333
H	L	H	74.250	OFF	24.000	33.333
H	H	L	74.1758	25.000	24.576	33.333
H	H	H	74.1758	25.000	4.9152	33.333

Voltage Control Crystal Oscillator (VCXO)

The AK8138C has a voltage control crystal oscillator (VCXO), featuring fine frequency tuning for 27MHz of primary clock frequency by external DC voltage control. This tuning enables output clock frequency to synchronize the external clock system. VIN (Pin 4) accepts DC voltage control from a processor or a system controller, and pulls the primary frequency of crystal to higher or lower. This pulling range is determined by crystal characteristic, on-chip load capacitor, and stray capacitance of PCB. The AK8138C is designed to range ± 110 ppm of primary frequency in AKM's authorized condition, and the typical pulling profile is shown in **Figure 1**. For details about the condition and other specific crystal application case, refer the AK8138 Family application note.

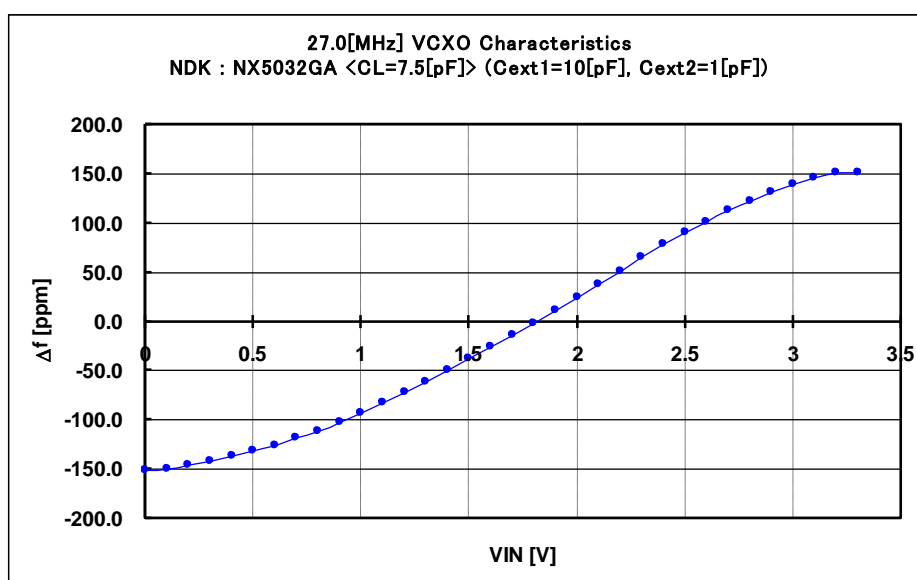
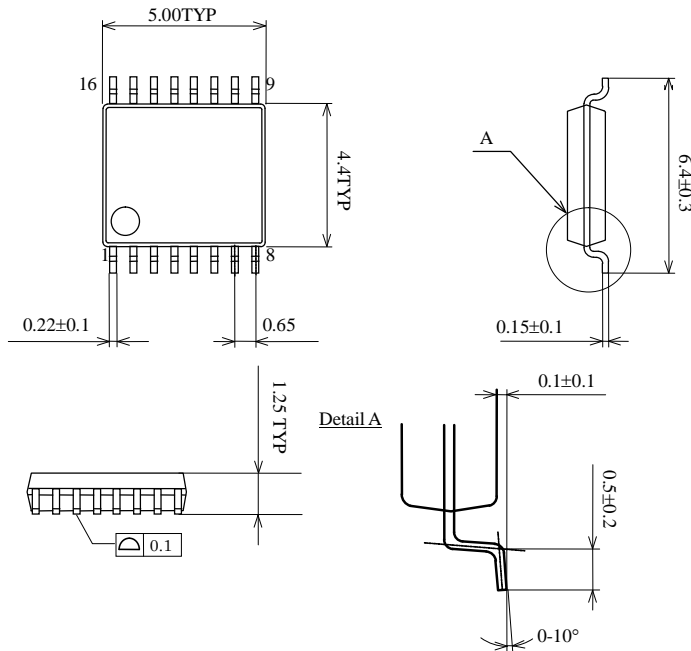


Figure 1: Typical VCXO Pulling Profile

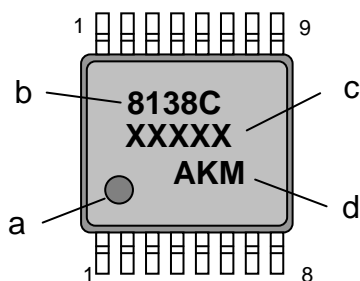
Package Information

• Mechanical data

16pin SSOP (Unit: mm)

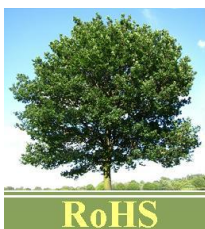


• Marking



- a: #1 Pin Index
- b: Part number
- c: Date code (5 digits)
- d: Product Family Logo ⁽¹⁾

• RoHS Compliance



All integrated circuits from Asahi Kasei Microdevices Corporation (AKM) assembled in “lead-free” packages* are fully compliant with RoHS.

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

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