Low Power Multiclock Generator with VCXO
AK8130F

Features

- 27MHz Crystal Input
- Four Frequency-Selectable Clock Outputs
- One 27MHz-Reference Output
- Selectable Clock out Frequencies:
  - 74.1758MHz/Off
  - 20.000, 25.000MHz
  - 4.9152, 12.000, 24.000MHz
  - 50.000MHz
- Built-in VCXO
  - Pull Range: ±110ppm (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℃
- Package:
  16-pin SSOP (Lead free)

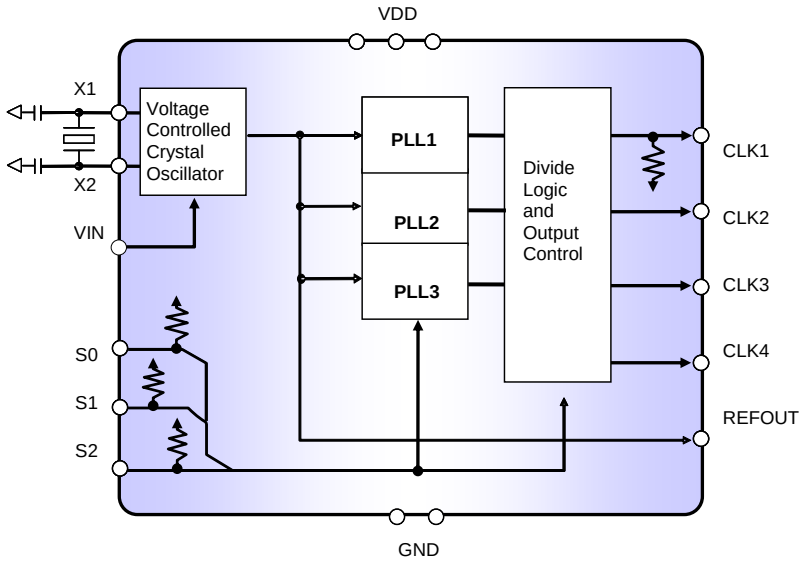
Description

The AK8130F 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 AK8130F 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 AK8130F 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 AK8130F is available in a 16-pin SSOP package.

Applications

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

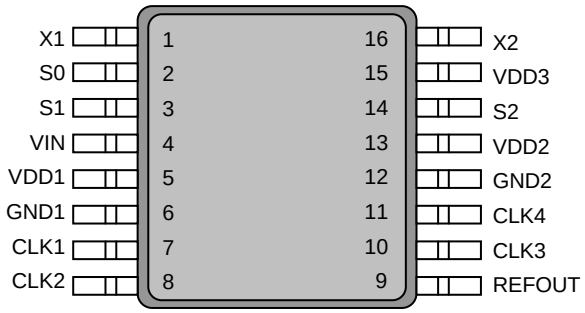
Block Diagram



AK8130F 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 (2)
8	CLK2	OUT	Clock output 2, See Table 1 for its selectable frequency
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 360kΩ

(2) Internal pull down 510kΩ

Ordering Information

Part Number	Marking	Shipping Packaging	Package	Temperature Range
AK8130F	8130F	Tape and Reel	16-pin SSOP	-20 to 85 ℃

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	Vin	VSS-0.3 to VDD+0.3	V
Input current (any pins except supplies)	I_{IN}	±10	mA
Storage temperature	Tstg	-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	Ta		-20		85	°C
Supply voltage (1)	VDD		3.0	3.3	3.6	V
Output Load Capacitance	Cp1	Pin: CLK1-4			15	pF
	Cp2	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℃, 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℃		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℃, 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±1.0V		150		ppm/V
Cycle to cycle Jitter(4)		CLK1-4 peak		210		ps
Period Jitter (4)		CLK1-4 peak to peak		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		60	120	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. ±110ppm is applied to AKM's authorized test condition.

(4) ±3σ in 10000 sampling or more

(5) ±3σ in 5000 sampling or more

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

Output clock frequency selection

The AK8130F generates a range of low-jitter and hi-accuracy clock frequencies with three built-in PLLs and provides to 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	74.1758	25.000	24.000	50.000
L	L	H	74.1758	20.000	24.000	50.000
L	H	L	74.1758	25.000	12.000	50.000
L	H	H	74.1758	20.000	12.000	50.000
H	L	L	74.1758	25.000	4.9152	50.000
H	L	H	74.1758	20.000	4.9152	50.000
H	H	L	OFF	25.000	4.9152	50.000
H	H	H	OFF	20.000	4.9152	50.000

Voltage Control Crystal Oscillator (VCXO)

The AK8130F 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 AK8130F is designed to range ±110ppm 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 AK8130 Family application note.

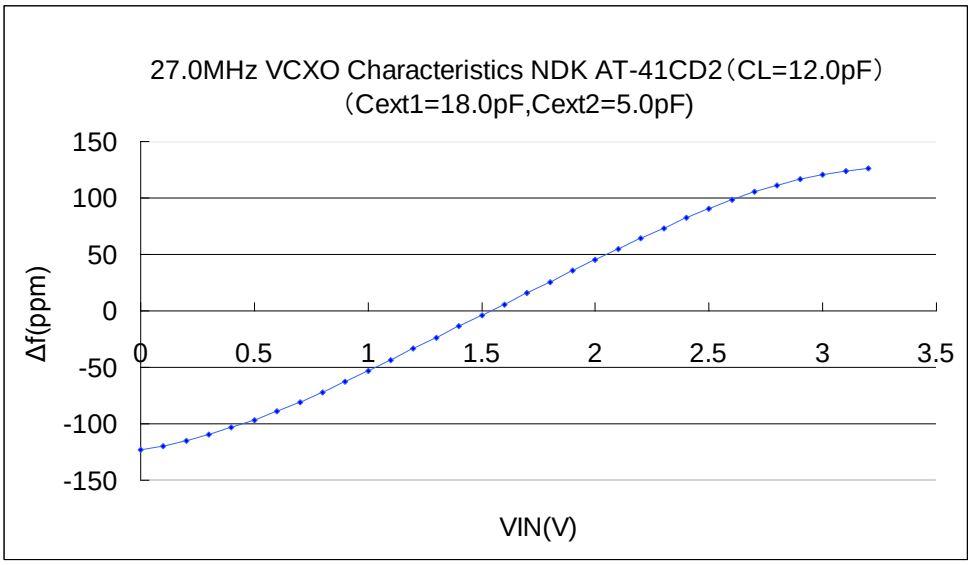


Figure 1: Typical VCXO Pulling Profile

Typical Connection Diagram

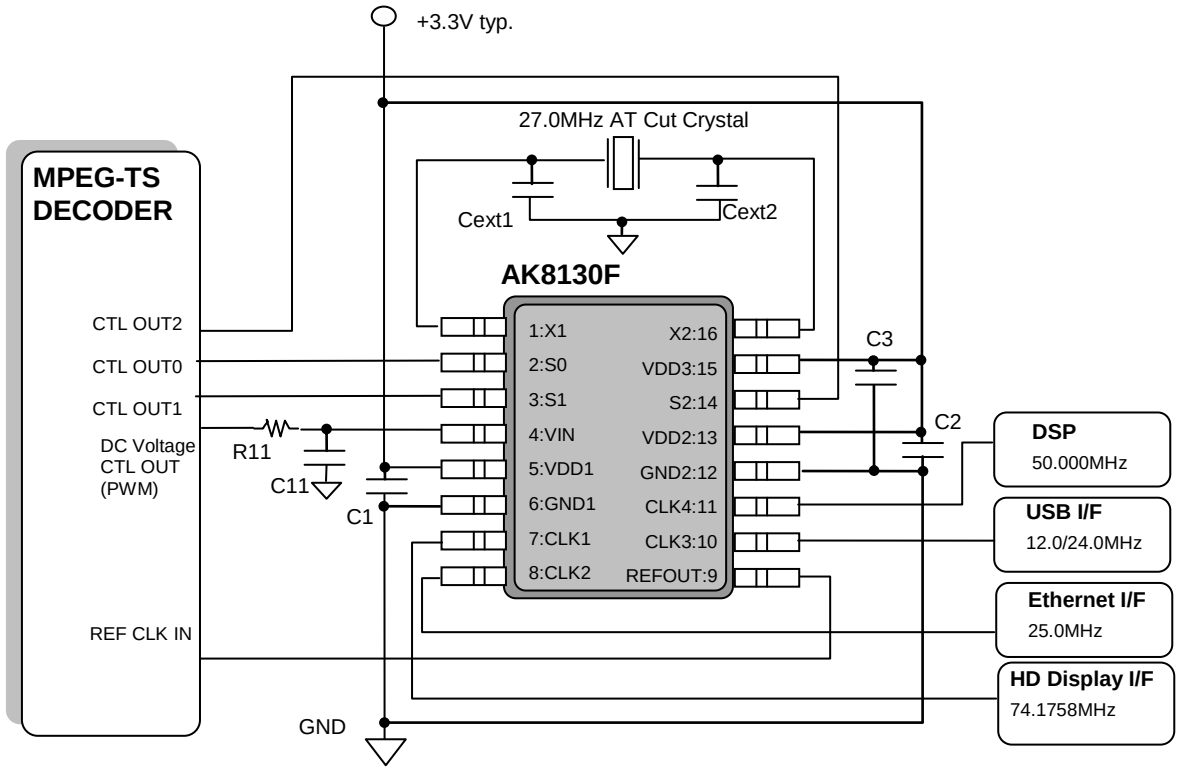


Figure 2: Typical Connection Diagram

C1, C2, C3: 0.1μF
Cext1, Cext2: Depends on crystal characteristics. Refer the specification of the crystal.
R11, C11: In case of interface by PWM. For right configuration, refer the specification of the applied processor.

PCB Layout Consideration

The AK8130F is a high-accuracy and low-jitter multi clock generator. For proper performances specified in this datasheet, careful PCB layout should be taken. The followings are layout guidelines based on the typical connection diagram shown in Figure 2

Power supply line – AK8130F has three power supply pins (VDD1-3) which deliver power to internal circuitry segments. A 0.1μF decoupling capacitor should be placed as close to each VDD pin as possible.

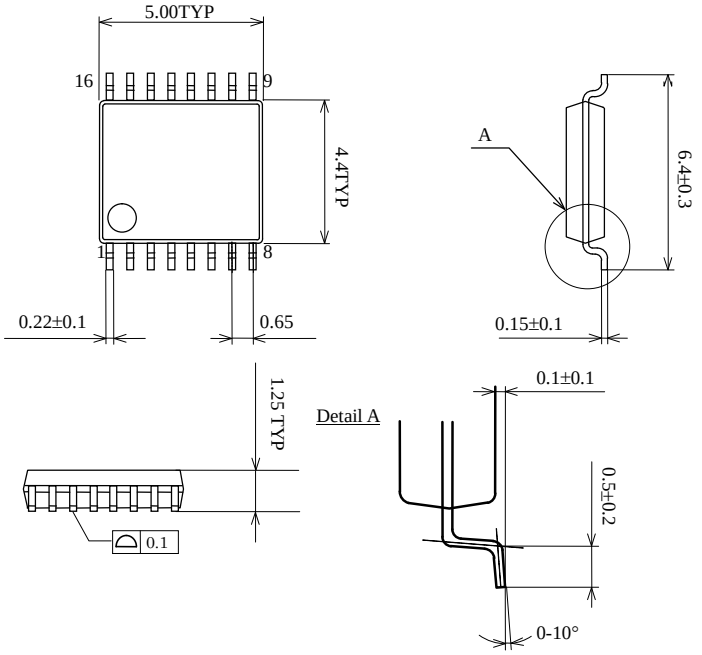
Ground pin connection – AK8130F has two ground pins (GND1-2). These pin require connecting to plane ground which will eliminate any common impedance with other critical switching signal return. 0.1μF decoupling capacitors placed at VDD1, VDD2, and VDD3 should be grounded at close to the GND1pin, the GND2 pin, and the GND2, respectively.

Crystal connection – Proper oscillation performance and pullable range are susceptible to stray or parasitic capacitors around crystal. The wiring traces to a crystal form X1 (Pin 1) and X2 (Pin 14) have equal lengths with no via and as short in length as possible. These traces should be also located away from any traces with switching signal.

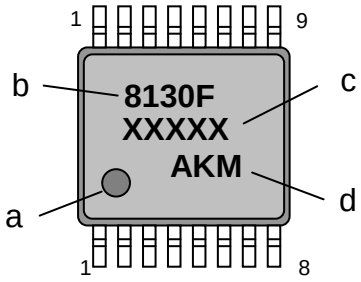
Package Information

• Mechanical data

16pin SSOP (Unit: mm)



• Marking



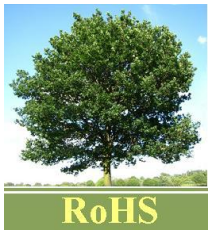
a: #1 Pin Index

b: Part number

c: Date code (5 digits)

d Product Family Logo (1)

• RoHS Compliance



All integrated circuits form 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.

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.