



# Low Power Multiclock Generator with VCXO AK8130

## Features

- 27MHz Crystal Input
- Four Frequency-Selectable Clock Outputs
- One 27MHz-Reference Output
- Selectable Clock out Frequencies:
  - 54.000, 74.1758, 74.250MHz
  - 25.000MHz
  - 4.9152MHz
  - 24.576, 33.333MHz
- Built-in VCXO
  - Pull Range:  $\pm 110$ ppm (Min.)
- Low Jitter Performance
  - Period Jitter: 150 psec (Typ.) at CLK1-4
  - Long Term Jitter : 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 TSSOP (Lead free)

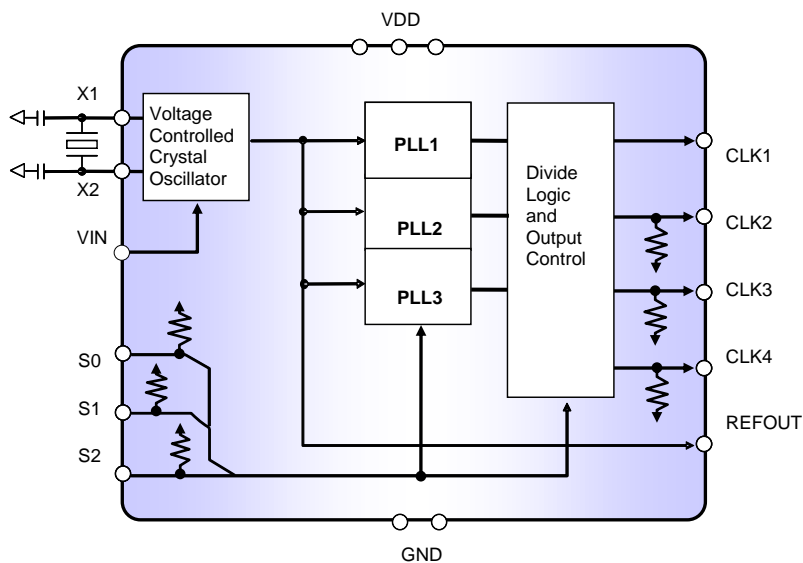
## Description

The AK8130 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 AK8130 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  $\pm 110$  ppm for synchronizing to the external clock system. Both circuitries of VCXO and PLL in AK8130 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 AK8130 is available in a 16-pin SSOP package.

## Applications

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

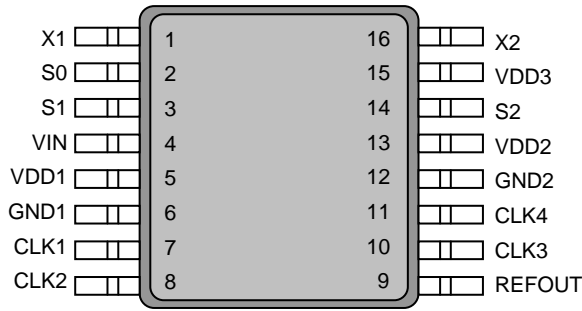
## Block Diagram



**AK8130 Multi Clock Generator**

Pin Descriptions

Package: 16-Pin TSSOP(Top View)



| Pin No. | Pin Name | Pin Type | Description   |
|---------|----------|----------|---|
| 1       | X1       | XO       | Crystal connection, Connect to 27.000MHz crystal                |
| 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 (2)    |
| 11      | CLK4     | OUT      | Clock output 4, See Table 1 for its selectable frequency (2)    |
| 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                |

(1) Internal pull up 360kΩ

(2) Internal pull down 510kΩ

Ordering Information

| Part Number | Marking | Shipping Packaging | Package      | Temperature Range |
|-------------|---------|--------------------|--------------|-------------------|
| AK8130      | 8130    | Tape and Reel      | 16-pin TSSOP | -20 to 85 °C      |

## 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                            | V <sub>in</sub>  | 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. AKM 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>  |             | -20 |     | 85  | °C   |
| Supply voltage <sup>(1)</sup> | VDD             |             | 3.0 | 3.3 | 3.6 | V    |
| Output Load Capacitance       | C <sub>p1</sub> | Pin: CLK1-4 |     |     | 15  | pF   |
|                               | C <sub>p2</sub> | 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 <sub>IH</sub> | Pin: S0,S1,S2  | 0.7VDD |      |        | V    |
| Low Level Input Voltage   | V <sub>IL</sub> | Pin: S0,S1,S2  |        |      | 0.3VDD | V    |
| Input Current 1           | I <sub>L1</sub> | Pin: S0,S1,S2  | -20    |      | +10    | μA   |
| Input Current 2           | I <sub>L2</sub> | PIN: VIN   | -3     |      | +3     | μA   |
| High Level Output Voltage | V <sub>OH</sub> | Pin: CLK1-4, REFOUT<br>I <sub>OH</sub> =-4mA                   | 0.8VDD |      |        | V    |
| Low level Output Voltage  | V <sub>OL</sub> | Pin: CLK1-4, REFOUT<br>I <sub>OL</sub> =+4mA                   |        |      | 0.2VDD | V    |
| Current Consumption       | I <sub>DD</sub> | Clock out selection by note <sup>(1)</sup><br>No load, 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 <sup>(3)</sup>    |                   | VIN at over 0 to VDD V                  | ±110 |         |     | ppm   |
| VCXO Gain                             | G <sub>VCXO</sub> | VIN range at 1.5V±1.0V                  |      | 150     |     | ppm/V |
| Period Jitter <sup>(4)</sup>          |                   | CLK1-4                                  |      | 150     |     | ps    |
| Long Term Jitter <sup>(5)</sup>       |                   | CLK1 at 54.000MHz<br>1000 cycle delay   |      | 0.5     |     | ns    |
|                                       |                   | CLK1 at 74.250MHz<br>1000 cycle delay   |      | 0.85    |     | ns    |
|                                       |                   | REFOUT at 27.000MHz<br>1000 cycle delay |      | 160     |     | ps    |
| Output Clock Duty Cycle               |                   | Pin: CLK1-4 <sup>(1)</sup>              | 45   | 50      | 55  | %     |
|                                       |                   | Pin: REFOUT <sup>(2)</sup>              | 40   | 50      | 60  | %     |
| Output Clock Rise Time                | t <sub>rise</sub> | Pin: CLK1-4 <sup>(1)</sup>              |      | 1.5     |     | ns    |
|                                       |                   | Pin: REFOUT <sup>(2)</sup>              |      | 2.5     |     | ns    |
| Output Clock Fall Time                | t <sub>fall</sub> | Pin: CLK1-4 <sup>(1)</sup>              |      | 1.5     |     | ns    |
|                                       |                   | Pin: REFOUT <sup>(2)</sup>              |      | 2.5     |     | ns    |
| Power-up Time                         |                   | Pin: CLK1-4 <sup>(1)</sup>              |      | 5       |     | ms    |
| Output Transition Time <sup>(6)</sup> |                   | Pin: CLK1 at<br>74.25 or 74.175MHz      |      | 200     |     | 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 1000 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 AK8130 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).

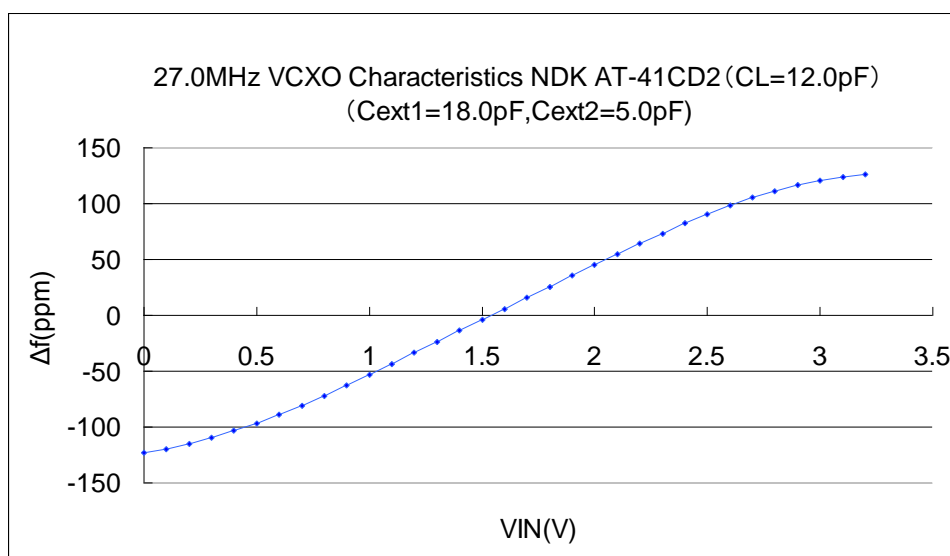
The selectable frequency is shown in **Table 1..**

**Table 1: Clock output Frequency**

| Selection Pin  |               |               | Clock Output Frequency (MHz) |                 |                  |                  |
|----------------|---------------|---------------|------------------------------|-----------------|------------------|------------------|
| S2<br>(Pin 14) | S1<br>(Pin 3) | S0<br>(Pin 2) | CLK1<br>(Pin 7)              | CLK2<br>(Pin 8) | CLK3<br>(Pin 10) | CLK4<br>(Pin 11) |
| L              | L             | L             | 74.250                       | 25.000          | OFF              | 33.333           |
| L              | L             | H             | 74.250                       | 25.000          | 4.9152           | OFF              |
| L              | H             | L             | 74.250                       | 25.000          | OFF              | 24.576           |
| L              | H             | H             | 54.000                       | OFF             | 4.9152           | 24.576           |
| H              | L             | L             | 74.1758                      | 25.000          | OFF              | 33.333           |
| H              | L             | H             | 74.1758                      | 25.000          | 4.9152           | OFF              |
| H              | H             | L             | 74.1758                      | 25.000          | OFF              | 24.576           |
| H              | H             | H             | 74.1758                      | OFF             | 4.9152           | 24.576           |

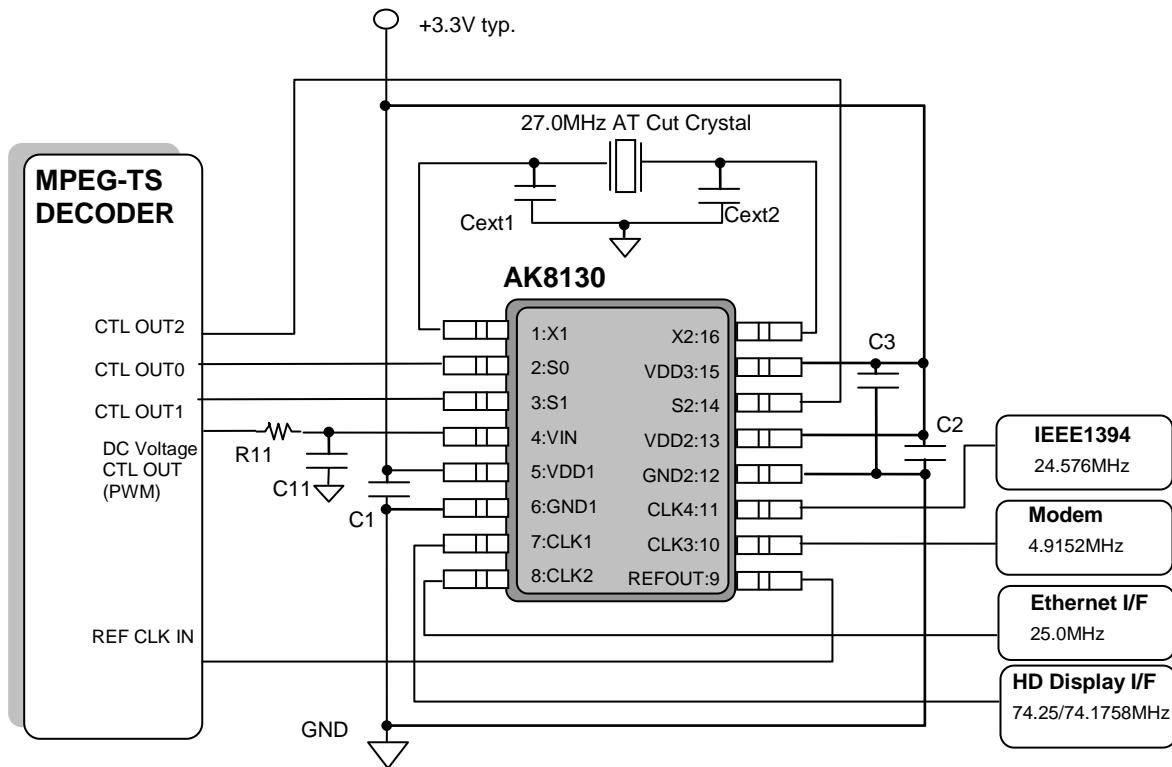
## Voltage Control Crystal Oscillator (VCXO)

The AK8130 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 AK8130 is designed to range  $\pm 110$ 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 AK8130 Family application note.



**Figure 1: Typical VCXO Pulling Profile**

## Typical Connection Diagram



**Figure 2: Typical Connection Diagram**

C1, C2, C3: 0.1 $\mu$ F

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 AK8130 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** – AK8130 has three power supply pins (VDD1-3) which deliver power to internal circuitry segments. A 0.1 $\mu$ F decoupling capacitor should be placed as close to each VDD pin as possible.

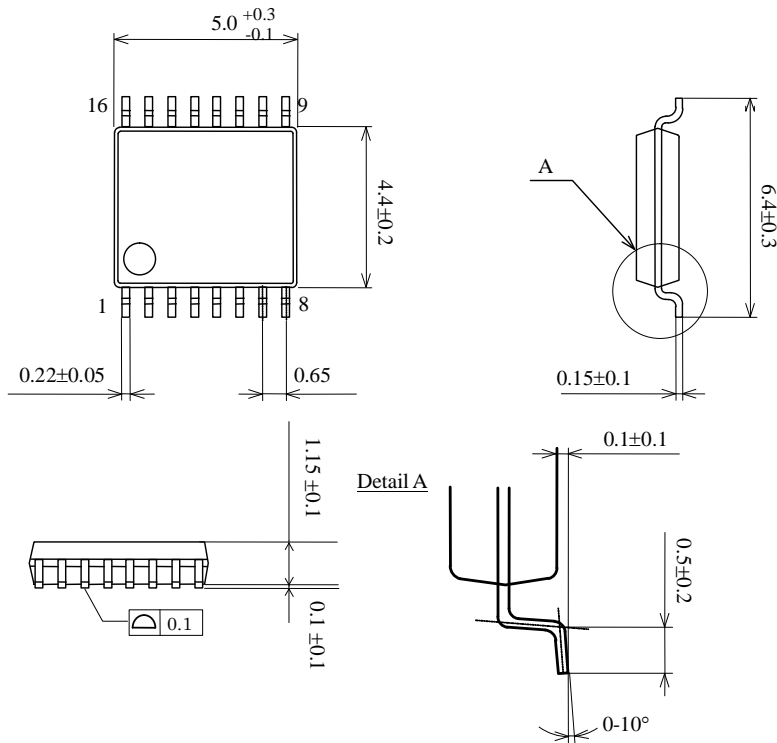
**Ground pin connection** – AK8130 has two ground pins (GND1-2). These pin require connecting to plane ground which will eliminate any common impedance with other critical switching signal return. 0.1 $\mu$ F decoupling capacitors placed at VDD1, VDD2, and VDD3 should be grounded at close to the GND1 pin, 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.

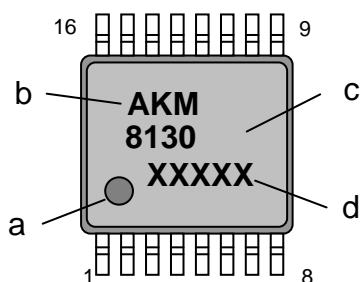
## Package Information

### • Mechanical data

16pin SSOP (Unit: mm)

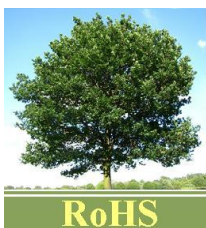


### • Marking



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

### • 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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