Integrated
Circuit
Systems, Inc.

AV9107C

CPU Frequency Generator

General Description

The **AV9107C** offers a tiny footprint solution for generating two simultaneous clocks. One clock, the REFCLK, is a fixed output frequency which is the same as the input reference crystal (or clock). The other clock, CLK1, can vary between 2 and 120 MHz, with up to 16 selectable preprogrammed frequencies stored in internal ROM (frequency range depends on design option).

The device has advanced features which include on-chip loop filters, tristate outputs, and power-down capability. A minimum of external components - two decoupling capacitors and an optional ferrite bead - are all that are required for jitter-free operation. Standard versions for computer motherboard applications are the **AV9107C-03**, and **AV9107C-05**. Custom masked versions, with customized frequencies and features, are available in 6-8 weeks for a small NRE.

Features

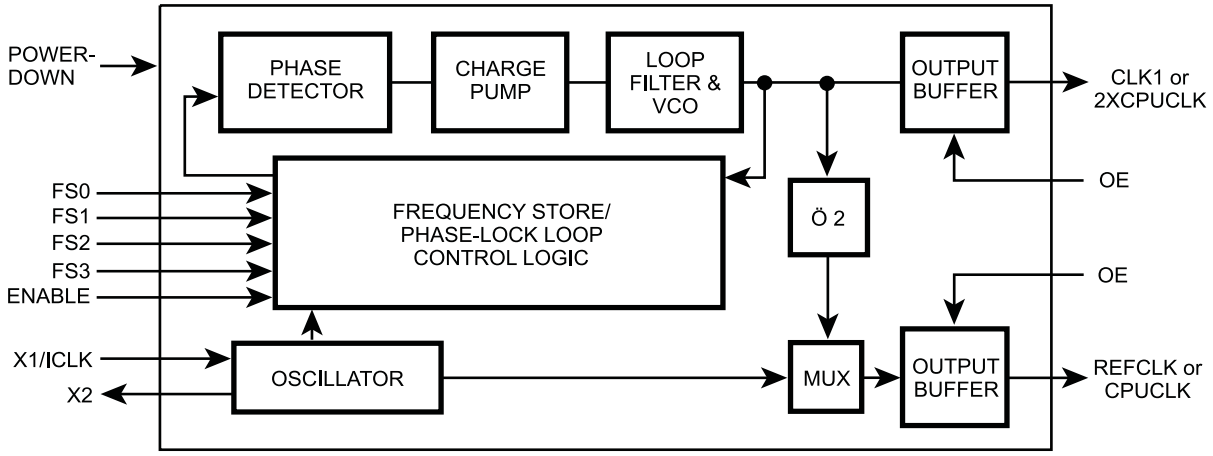
- Patented on-chip Phase-Locked Loop with VCO for clock generation
- Provides reference clock and synthesized clock
- Generates frequencies from 2 to 120 MHz (depending on option), operates to 80 MHz for V_{DD} 3.3V±10%
- 8-pin DIP or SOIC package or 14-pin DIP or SOIC package
- 2 to 32 MHz input reference frequency (depending on option)
- On-chip loop filter
- Up to 16 frequencies stored internally
- Low power CMOS technology
- Single +3.3 or +5 volt power supply

Applications

Graphics: The **AV9107C** is the easiest to use, lowest cost, and smallest footprint frequency generator for graphics applications. It can generate up to 16 different frequencies, including all frequencies necessary for VGA standards. It should be used in place of the AV9105/6 when the reference clock is also needed.

Computer: The **AV9107C** is the ideal solution for replacing high speed oscillators and for reducing clock speeds to save power in computers. The device provides smooth, glitch-free frequency transitions so that the CPU can continue to operate during slow down or speed up. The rate of frequency change makes the **AV9107C** compatible with all 386DX, 386SX, 486DX, 486DX2, and 486SX devices. Standard versions include the **AV9107C**-03, -05, -10, -11. Disk Drives: Smaller than a single crystal or an oscillator, the tiny SOIC package can be used for any general purpose frequency generation in disk drives.

Block Diagram



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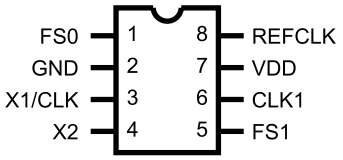
Applications (cont.)

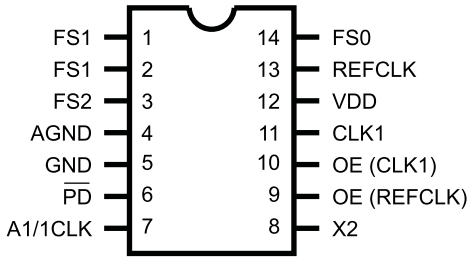
The most popular application is for Constant Density Recording, where its low jitter output clock provides the necessary frequencies for reading and recording. Another popular application is for slowing the disk drive CPU to save power.

High Speed Systems: **TheAV9107C** can be used as a proximity oscillator - using a low frequency (down to 2 MHz) input to generate a high frequency clock (up to 120 MHz) near the device requiring the high frequency (depending on option). This avoids the need to route high speed traces over a long distance.

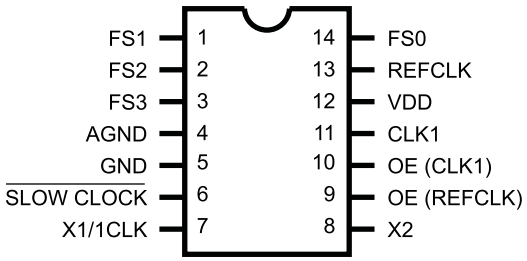
Pin Configuration



AV9107C-05/-10
8-Pin DIP, SOIC



AV9107C-03
14-Pin DIP, SOIC



AV9107C-11
14-Pin DIP, SOIC

Actual Frequencies

Decoding Table for AV9107C-05, 14.318 MHz input

FS1	FS0	CLK1
0	0	40.01 MHz
0	1	50.11 MHz
1	0	66.61 MHz
1	1	80.01 MHz

Decoding Table for AV9107C-10, 14.318 MHz input

FS1	FS0	CLK1
0	0	25.06 MHz
0	1	33.29 MHz
1	0	40.00 MHz
1	1	50.11 MHz

Decoding Table for AV9107C-03, 14.318 MHz input

FS3	FS2	FS1	FS0	CLK1
0	0	0	0	16.00 MHz
0	0	0	1	39.99 MHz
0	0	1	0	50.11 MHz
1	0	1	1	80.01 MHz
0	1	0	0	66.58 MHz
0	1	0	1	100.23 MHz*
0	1	1	0	8.02 MHz
0	1	1	1	4.01 MHz
1	0	0	0	8.02 MHz
1	0	0	1	20.00 MHz
1	0	1	0	25.06 MHz
1	0	1	1	40.01 MHz
1	1	0	0	33.29 MHz
1	1	0	1	50.11 MHz*
1	1	1	0	4.01 MHz
1	1	1	1	2.05 MHz

*@ VDD=5 volts

Decoding Table for AV9107C-11 (in MHz)

$\overline{\text{SLOW CLOCK}}$	FS3	FS2	FS1	FS0	CLK1
1	0	0	0	0	16.00 MHz
1	0	0	0	1	39.99 MHz
1	0	0	1	0	50.11 MHz
1	1	0	1	1	80.01 MHz
1	0	1	0	0	66.58 MHz
1	0	1	0	1	100.23 MHz*
1	0	1	1	0	8.02 MHz
1	0	1	1	1	4.01 MHz
1	1	0	0	0	8.02 MHz
1	1	0	0	1	20.00 MHz
1	1	0	1	0	25.06 MHz
1	1	0	1	1	39.99 MHz
1	1	1	0	0	33.25 MHz
1	1	1	0	1	50.11 MHz
1	1	1	1	0	30.00 MHz
1	1	1	1	0	4.01 MHz
0	1	1	1	1	8.05 MHz

*@ VDD=5 volts

Pin Descriptions for AV9107C-03, AV9107C-05, AV9107C-10 and AV9107C-11

PIN NUMBER			PIN NAME	TYPE	DESCRIPTION
-05/-10	-03	-11			
1	14	14	FS0	Input	Frequency Select 0 for CLK1 (-03 and -11 have pull-ups).
5	1	1	FS1	Input	Frequency Select 1 for CLK1 (-03 and -11 have pull-ups).
	2	2	FS2	Input	Frequency Select 2 for CLK1 (-03 and -11 have pull-ups).
	3	3	FS3	Input	Frequency Select 3 for CLK1 (-03 and -11 have pull-ups).
	4	4	AGND	-	Analog GROUND.
2	5	5	GND	-	Digital GROUND.
	6		$\overline{PD}$	Input	POWER-DOWN. Shuts off chip when low. Internal pull-up.
		6	$\overline{SLOW\ CLOCK}$	Input	SLOW CLOCK input. Forces CLK1 to 8 MHz (regardless of FS condition). Has internal pull-up.
3	7	7	X1/ICLK	Input	CRYSTAL OUTPUT or INPUT CLOCK frequency. Typically 14.318 MHz system clock. This input includes load capacitance and feedback bias for a crystal.
4	8	8	X2	Output	CRYSTAL OUTPUT (No Connect when clock used.) This input includes XTAL load capacitance.
	9	9	OE(REFCLK)	Input	OUTPUT ENABLE. Tristates REFCLK when low. Has internal pull-up.
	10	10	OE(CLK1)	Input	OUTPUT ENABLE. Tristates CLK1 when low. Has internal pull-up.
6	11	11	CLK1	Output	CLOCK1 Output (see decoding tables).
7	12	12	VDD	-	Digital power supply.
8	13	13	REFCLK	Output	REFERENCE CLOCK output. Produces a buffered version of the input clock or crystal frequency (typically 14.318 MHz).

Frequency Accuracy and Calculation

The accuracy of the frequencies produced by the **AV9107C-07** depends on the input frequency and the desired actual output frequency. The formula for calculating the exact frequency is as follows:

$$\text{Output Frequency} = \text{Input Frequency} \infty \frac{A}{B}$$

where A=2, 3, 4 ... 128, and
B=2, 3, 4 ... 32.

For example, to calculate the actual output frequency for a video monitor expecting a 44.900 MHz clock and using a 14.318 MHz input clock, the closest A/B ratio is 69/22, which gives an output of 44.906 MHz (within 0.02% of the target frequency). Generally, the **AV9107C-07** can produce frequencies within 0.1% of the desired output.

Frequency Transitions

A key **AV9107C-07** feature is the ability to provide glitch-free frequency transitions across its output frequency range. The **AV9107C-07-03** provides smooth transitions between any of the two groups of eight frequencies (when FS3=0 or FS3=1), so that the device will switch glitch-free between 4-100 MHz and 2-50 MHz.

Allowable Input and Output Frequencies for Possible Options

The input frequency should be between 2 and 32 MHz, depending on options, and the A/B ratio should not exceed 24. The output should fall in the range of 2-120 MHz, depending on options.

Output Enable

The Output Enable feature tristates the specified output clock pins. This places the selected output pins in a high impedance state to allow for system level diagnostic testing.

Power-Down

If equipped, the power-down shuts off the specified PLL or entire chip to save current. A few milliseconds are required to reach full functioning speed from a power-down state.

$\overline{\text{Slow Clock}}$

If equipped, the $\overline{\text{Slow Clock}}$ forces a smooth frequency transition on the VCO to an 8 MHz output on CLK1 when $\overline{\text{Slow Clock}}$ is taken to logic low level. A few milliseconds are required for the frequency transition into and out of the $\overline{\text{Slow Clock}}$ Mode.

Absolute Maximum Ratings

AVDD, VDD referenced to GND 7V

Operating temperature under bias ..... 0°C to +70°C

Storage temperature ..... -65°C to +150°C

Voltage on I/O pins referenced to GND ..... GND -0.5V to VDD +0.5V

Power dissipation ..... 0.5 Watts

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect product reliability.

Electrical Characteristics at 5V

Operating V_{DD} = +4.5V to +5.5V; T_A =0°C to 70°C unless otherwise stated

DC Characteristics						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Low Voltage	V_{IL}				0.8	V
Input High Voltage	V_{IH}		2.0	-	-	V
Input Low Current	I_{IL}	V_{IN}=0V (Pull-up input)	-16.0	-6.0	-	µA
Input Low Current	I_{IL}	V_{IN}=0V (Input with no pull-up)	-2.0	-	2.0	µA
Input High Current	I_{IH}	V_{IN}=VDD	-2.0	-	2.0	µA
Output Low Voltage[1]	V_{OL}	I_{OL}=10mA	-	0.15	0.40	V
Output High Voltage[1]	V_{OH}	I_{OH}=-30mA	2.4	3.25	-	V
Output Low Current[1]	I_{OL}	V_{OL}=0.8V	22.0	35.0	-	mA
Output High Current[1]	I_{OH}	V_{OH}=2.0V	-	-50.0	-35.0	mA
Supply Current	I_{DD}	Unload, 50 MHz	-	18.0	42.0	mA
Supply Current; Power-down (-03 only)	I_{DD} (PD low)	Unload, Logic Inputs 000	-	38.0	100.0	µA
Supply Current; Power-down (-03 only)	I_{DD} (PD low)	Unload, Logic Inputs 111	-	14.0	40.0	µA
Supply Current; Slow Clock (-11 only)	I_{DD} (Slow Clock low)	Unloaded, Slow Clock pin low	-	5.5	9.0	mA
Pull-up Resistor[1]	R_{pu}		-	380.0	700.0	k ohms
AC Characteristics						
Rise Time[1]	T_r	15pF load, 0.8 to 2.0V	-	0.60	1.40	ns
Fall Time[1]	T_f	15pF load, 2.0 to 0.8V	-	0.40	1.00	ns
Rise Time[1]	T_r	15pF load, 20% to 80%	-	2.0	3.5	ns
Fall Time[1]	T_f	15pF load, 80 to 20%	-	1.0	2.5	ns
Duty Cycle[1]	D_t	15pF load @ 1.4V	45.0	50.0	55.0	%
Jitter, One Sigma[1]	T_{jis}	From 20 to 100 MHz	-	50.0	150.0	ps
Jitter, One Sigma[1]	T_{jis}	From 14 to 16 MHz	-	100.0	200.0	ps
Jitter, One Sigma[1]	T_{jis}	From 14 to Below	-	0.2	1.0	%
Jitter, Absolute[1]	T_{jab}	From 20 to 100 MHz	-250.0	-	250.0	ps
Jitter, Absolute[1]	T_{jab}	From 14 to 16 MHz	-500.0	-	500.0	ps
Jitter, Absolute[1]	T_{jab}	From 14 to Below	-	1.0	3.0	%
Input Frequency[1]	F_i		11.0	14.3	19.0	MHz
Output Frequency[1]	F_o		2.0	-	120.0	MHz
Power-up Time[1]	T_{pu}		-	7.58	18.0	ms
Transition Time[1]	T_{ft}	8 to 66.6 MHz	-	6.0	13.0	ms

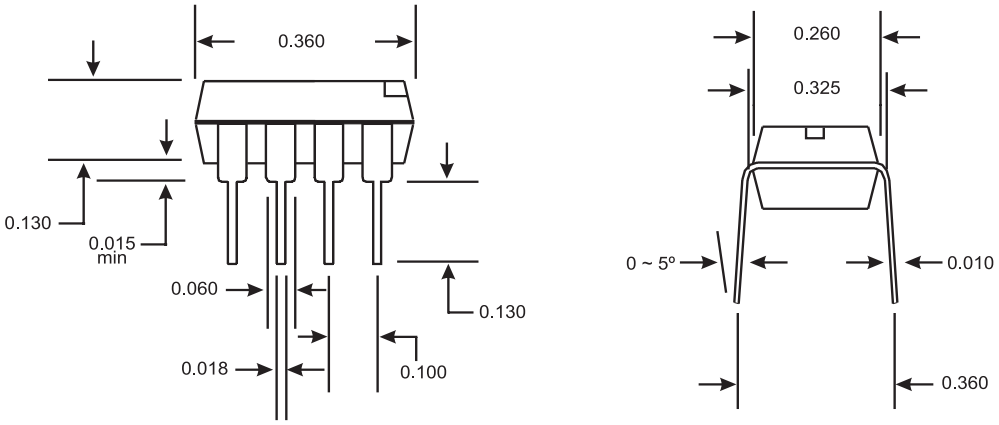
Note: 1. Parameter is guaranteed by design and characterization. Not 100% tested in production.

Electrical Characteristics at 3.3V

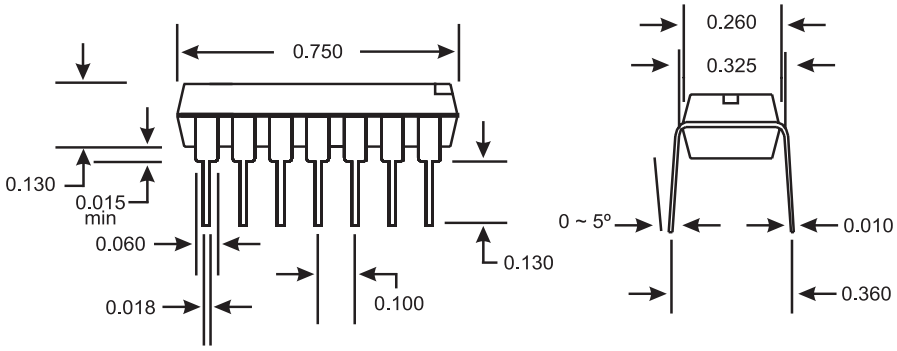
Operating V_{DD} = +3.0V to +3.7V; T_A =0°C to 70°C unless otherwise stated

DC Characteristics						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNITS
Input Low Voltage	V_{IL}		-	-	$0.20V_{DD}$	V
Input High Voltage	V_{IH}		$0.7V_{DD}$	-	-	V
Input Low Current	I_{IL}	V_{IN}=0V (Pull-up input)	-7.0	-2.5	-	µA
Input Low Current	I_{IL}	V_{IN}=0V (Input with no pull-up)	-2.0	-	2.0	µA
Input High Current	I_{IH}	$V_{IN}=V_{DD}$	-2.0	-	2.0	µA
Output Low Voltage[1]	V_{OL}	I_{OL}=6mA	-	0.05	0.1	V_{DD}
Output High Voltage[1]	V_{OH}	I_{OH}=-5mA	0.85	0.92	-	V_{DD}
Output Low Current[1]	I_{OL}	$V_{OL}=0.2V_{DD}$	15.0	22.0	-	mA
Output High Current[1]	I_{OH}	$V_{OL}=0.7V_{DD}$	-	-17.0	-10.0	mA
Supply Current	I_{DD}	Unloaded, 50 MHz	-	22.0	40.0	mA
Supply Current; Power-down (-03 only)	I_{DD} (PD low)	Unload, Logic Inputs 000	-	13.0	40.0	µA
Supply Current; Power-down (-03 only)	I_{DD} (PD low)	Unload, Logic Inputs 111	-	4.0	12.0	µA
Supply Current; Slow Clock (-11 only)	I_{DD} (Slow Clock low)	Unloaded, Slow Clock pin low	-	3.5	6.0	mA
Pull-up Resistor[1]	R_{pu}		-	550.0	900.0	k ohms
AC Characteristics						
Rise Time[1]	T_r	15pF load, 20% to 80%	-	2.2	3.5	ns
Fall Time[1]	T_f	15pF load, 80% to 20%	-	1.2	2.5	ns
Duty Cycle[1]	D_t	15pF load @ 50%	40.0	46.0	53.0	%
Jitter, One Sigma[1]	T_{jis}	From 25 to 80 MHz	-	50.0	150.0	ps
Jitter, One Sigma[1]	T_{jis}	From 14 to 20 MHz	-	100.0	200.0	ps
Jitter, One Sigma[1]	T_{jis}	From 14 to Below	-	0.4	1.0	%
Jitter, Absolute[1]	T_{jab}	From 25 to 80 MHz	-250.0	-	250.0	ps
Jitter, Absolute[1]	T_{jab}	From 14 to 20 MHz	-500.0	-	500.0	ps
Jitter, Absolute[1]	T_{jab}	From 14 to Below	-	1.0	3.0	%
Input Frequency[1]	F_i		13.3	14.3	15.3	MHz
Output Frequency[1]	F_o		2.0	-	66.6	MHz
Power-up Time[1]	T_{pu}		-	7.58	18.0	ms
Transition Time[1]	T_{ft}	8 to 66.6 MHz	-	6.0	13.0	ms

Note: 1. Parameter is guaranteed by design and characterization. Not 100% tested in production.



8-Pin DIP Package



14-Pin DIP Package

Ordering Information

AV9107C-05CN8, AV9107C-10CN8, AV9107C-03CN14, AV9107C-11CN14

Example:

XXX XXXX-PPP M X#W

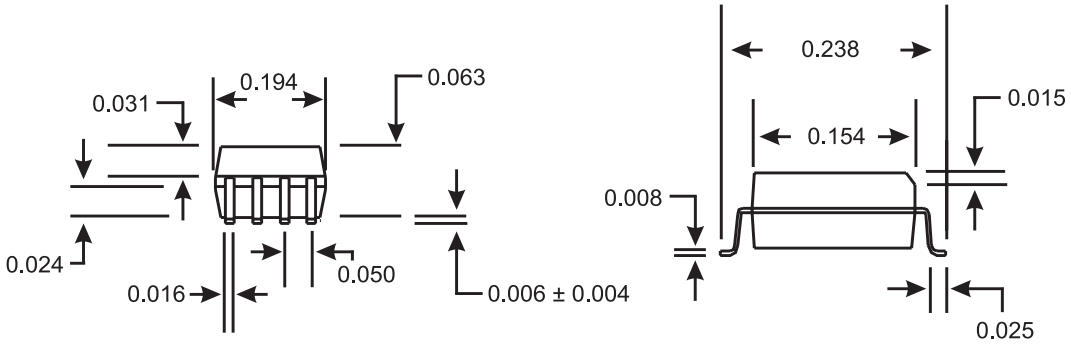
Lead Count & Package Width
Lead Count=1,2, or 3 digits
W=0.3" SOIC or 0.6" DIP; None=Standard Width

Package Type
N=DIP (Plastic)

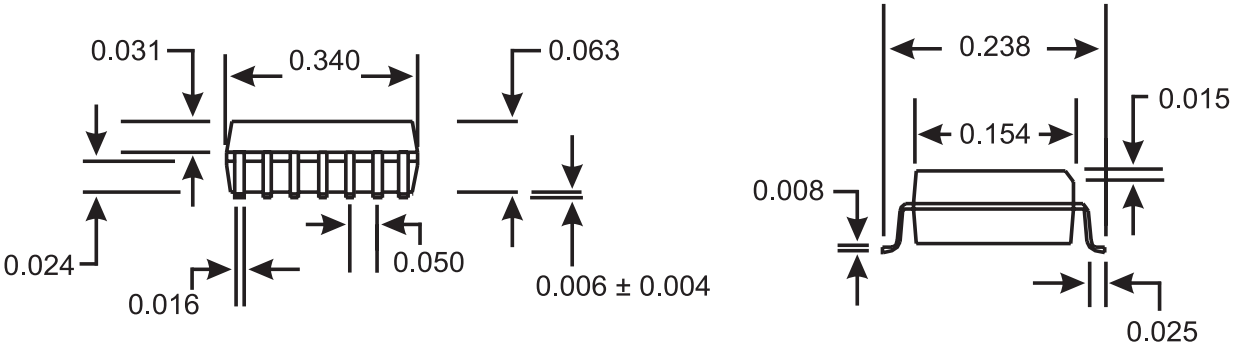
Pattern Number (2 or 3-digit number for parts with ROM-code patterns, if applicable)

Device Type (consists of 3 or 4-digit numbers)

Prefix
ICS, AV=Standard Device



8-Pin Plastic SOIC Package



14-Pin SOIC Package

Ordering Information

AV9107C-03CS14, AV9107C-05CS08, AV9107C-10CS08, AV9107C-11CS14

Example:

XXX XXXX-PPP M X#W

Lead Count & Package Width
Lead Count=1,2, or 3 digits
W=0.3" SOIC or 0.6" DIP; None=Standard Width

Package Type
S=SOIC

Pattern Number (2 or 3-digit number for parts with ROM-code patterns)

Device Type (consists of 3 or 4-digit numbers)

Prefix
ICS, AV=Standard Device