



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.

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.

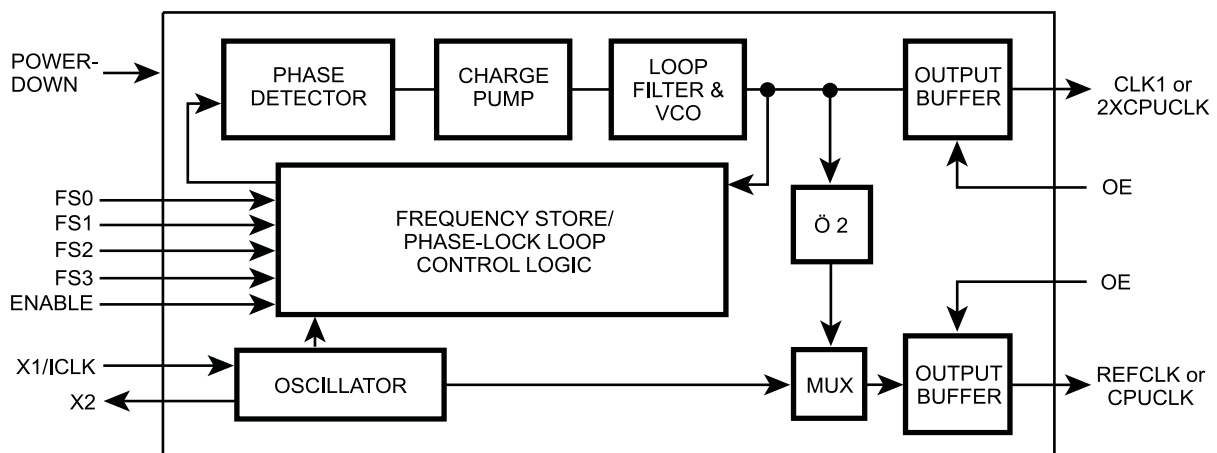
Computer: The AV9107C is the ideal solution for replacing high speed oscillators and for reducing clock speeds to save

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

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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PowerPC is a trademark of Motorola Corporation



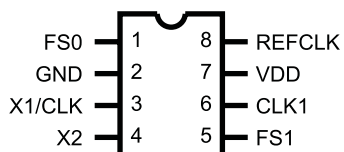
AV9107C

Applications (cont.)

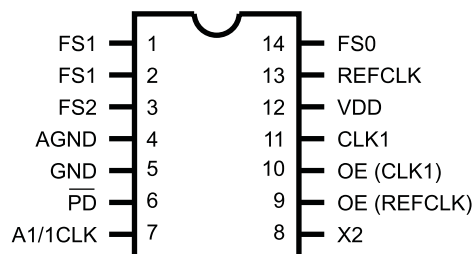
The most popular application is for Constant Density Recording, where its low jitter output clock provides the necessary frequencies for reading and recording. Another popular application is for slowing the disk drive CPU to save power.

High Speed Systems: **The AV9107C** 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.

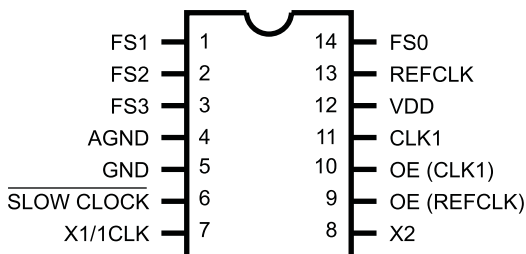
Pin Configuration



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 100.23 MHz* 8.02 MHz |
| 0 | 1 | 0 | 1 | 4.01 MHz |
| 0 | 1 | 1 | 0 | 8.02 MHz |
| 0 | 1 | 1 | 1 | 20.00 MHz |
| 1 | 0 | 0 | 0 | 25.06 MHz |
| 1 | 0 | 0 | 1 | 40.01 MHz |
| 1 | 0 | 1 | 0 | 33.29 MHz |
| 1 | 0 | 1 | 1 | 50.11 MHz* |
| 1 | 1 | 0 | 0 | 4.01 MHz |
| 1 | 1 | 0 | 1 | 2.05 MHz |
| 1 | 1 | 1 | 0 | |
| 1 | 1 | 1 | 1 | |

*@ VDD=5 volts

Decoding Table for AV9107C-11 (in MHz)

| 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



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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 | | $\overline{\text{PD}}$ | Input | POWER-DOWN. Shuts off chip when low. Internal pull-up. |
| | | 6 | SLOW CLOCK | Input | SLOW CLOCK input. Forces CLK1 to 8 MHz (regardless of FS condition). Has internal pull-up. |
| 3 | 7 | 7 | X1/CLK | 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:

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

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.

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.

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.

Slow Clock

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



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Electrical Characteristics at 5V

Operating $V_{DD} = +4.5V$ to $+5.5V$; $T_A = 0^\circ C$ to $70^\circ C$ 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} | $V_{IN}=V_{DD}$ | -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

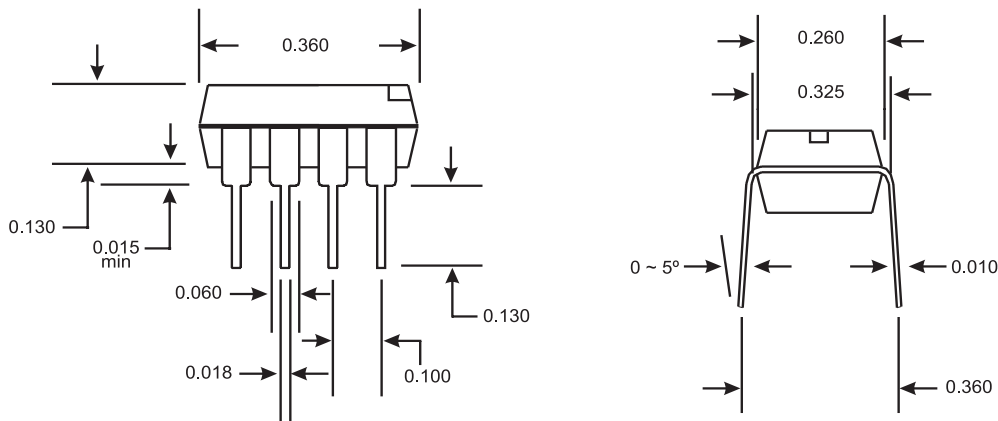
Operating $V_{DD} = +3.0V$ to $+3.7V$; $T_A = 0^{\circ}C$ to $70^{\circ}C$ unless otherwise stated

| 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 |

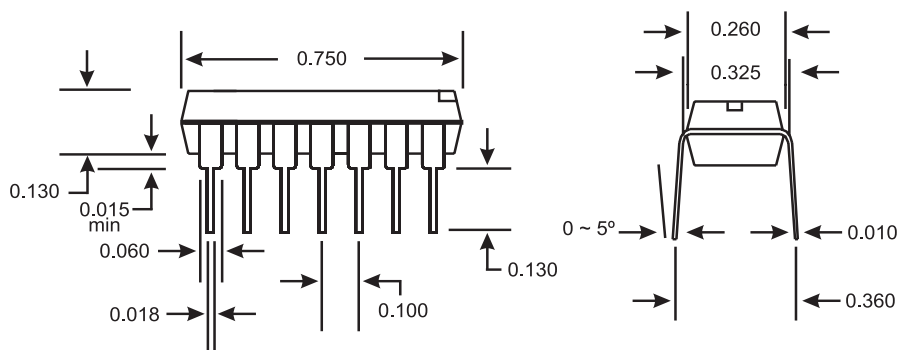
Note: 1. Parameter is guaranteed by design and characterization. Not 100% tested in production.



AV9107C



8-Pin DIP Package



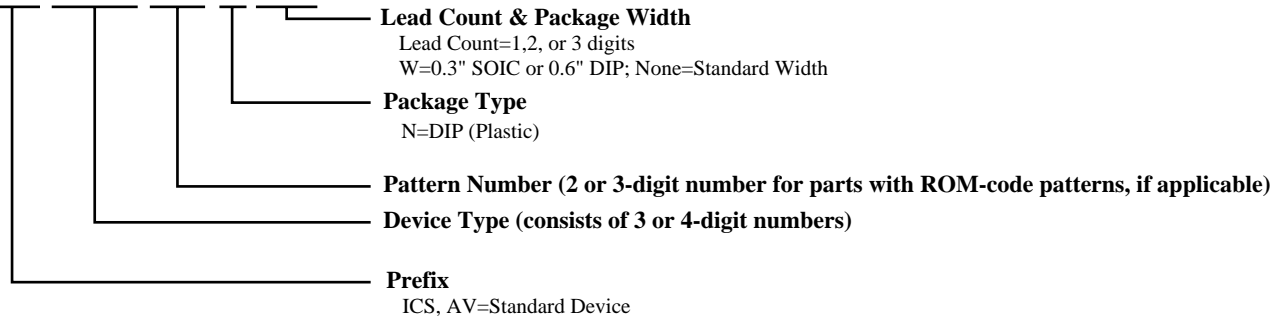
14-Pin DIP Package

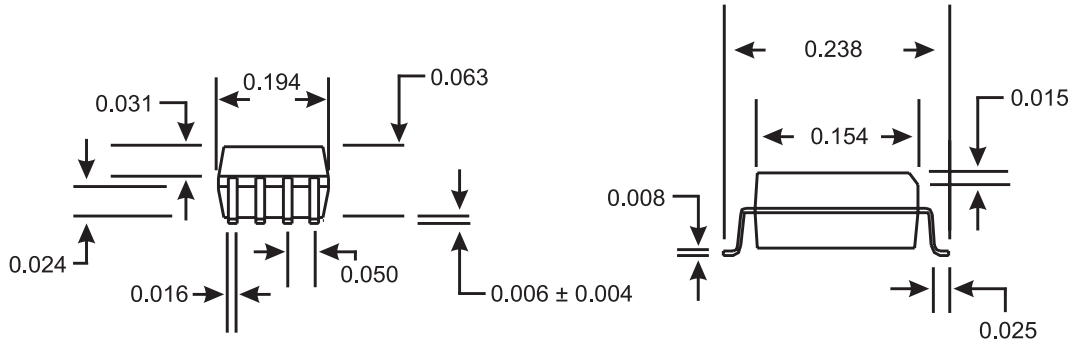
Ordering Information

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

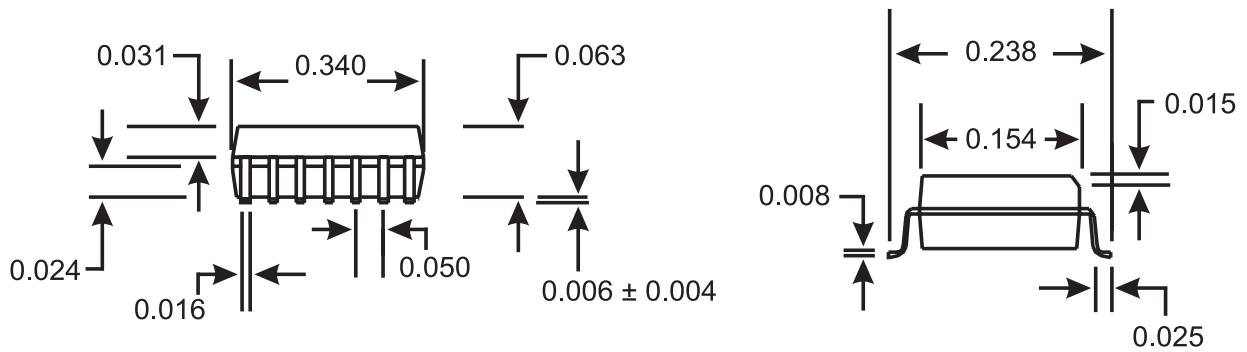
Example:

XXX XXXX-PPP M X#W





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

