

CPU Frequency Generator

General Description

The **AV9108** 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.

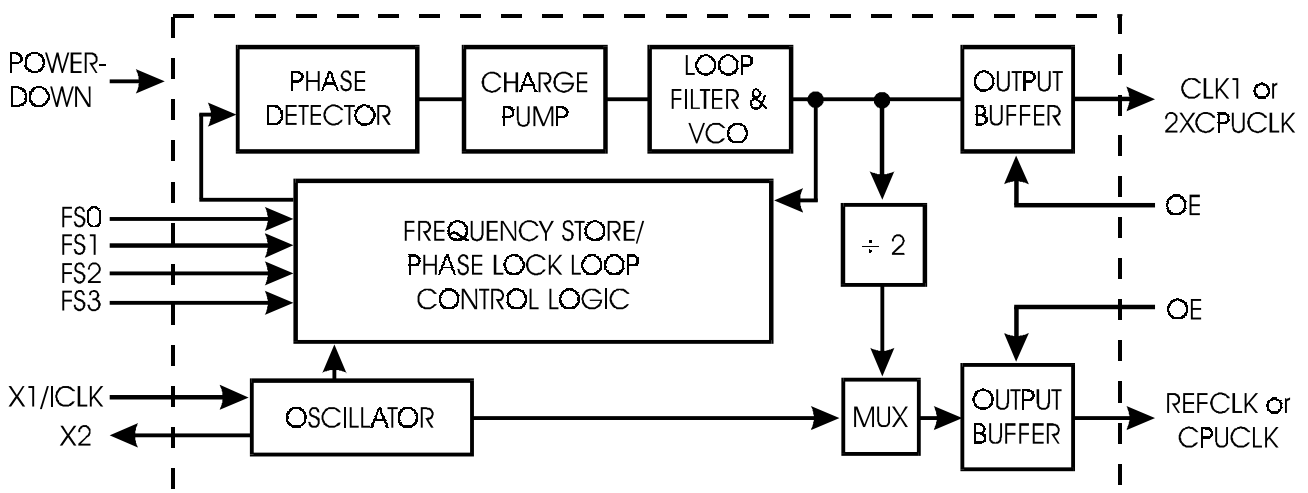
The **ICS9108** is ideal for use in a 3.3V system. It can generate a 66.66 MHz clock at 3.3V. In addition, the **ICS9108** provides a symmetrical wave form with a worst case duty cycle of 45/55. The **ICS9108** has very tight edge control between the CPU clock and 2XCPU clock outputs, with a worst case skew of 250ps.

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 **AV9108-03**, **AV9108-05** and the **ICS9108-10**. Custom masked versions, with customized frequencies and features, are available in 6-8 weeks for a small NRE fee.

Features

- Runs up to 80 MHz at 3.3V
- 50/50 typical duty cycle at 5V
- ± 250 ps absolute jitter
- Generates frequencies from 2 to 140 MHz
- 2 to 32 MHz input reference frequency
- Up to 16 frequencies stored internally
- Patented on-chip Phase Locked Loop with VCO for clock generation
- Provides reference clock and synthesized clock
- On-chip loop filter
- Low power 0.8 μ CMOS technology
- 8-pin or 14-pin DIP or SOIC package

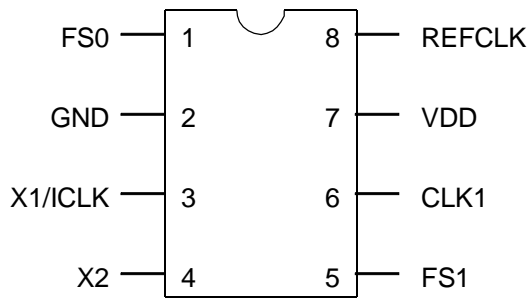
Block Diagram



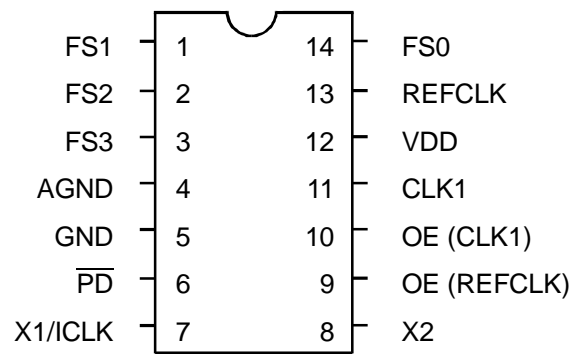


AV9108

Pin Configuration



AV9108-05/-10
8-Pin DIP, SOIC



AV9108-03/-11
14-Pin DIP, SOIC

Pin Descriptions for AV9108-03, AV9108-05 and AV9108-10

| PIN NUMBER | | PIN NAME | TYPE | DESCRIPTION |
|-------------|-----|-----------------|--------|---|
| -05/-10/-13 | -03 | | | |
| 1 | 14 | FS0 | Input | Frequency Select 0 for CLK1 (-03 has pull-up). |
| 5 | 1 | FS1 | Input | Frequency Select 1 for CLK1 (-03 has pull-up). |
| | 2 | FS2 | Input | Frequency Select 2 for CLK1 (-03 has pull-up). |
| | 3 | FS3 | Input | Frequency Select 3 for CLK1 (-03 has pull-up). |
| | 4 | AGND | - | Analog GROUND. |
| 2 | 5 | GMD | - | Digital GROUND. |
| | 6 | \overline{PD} | Input | POWER-DOWN. Shuts off chip when low. Internal pull-up. |
| 3 | 7 | X1/ICLK | Input | CRYSTAL OUTPUT or INPUT CLOCK frequency. Typically 14.318 MHz system clock. |
| 4 | 8 | X2 | Output | CRYSTAL OUTPUT (No Connect when clock used.). |
| | 9 | OE(REFCLK) | Input | OUTPUT ENABLE. Tristates REFCLK when low. Pull-up. |
| | 10 | OE(CLK1) | Input | OUTPUT ENABLE. Tristates CLK1 when low. Pull-up. |
| 6 | 11 | CLK1 | Output | CLOCK1 Output (see decoding tables). |
| 7 | 12 | VDD | - | Digital power supply (+3V DC). |
| 8 | 13 | REFCLK | Output | REFERENCE CLOCK output. Produces a buffered version of the input clock or crystal frequency (typically 14.318 MHz). |



Actual Frequencies

Decoding Table for AV9108-05, 14.318 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 AV9108-03, 14.318 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 |

Decoding Table for AV9108-10, 14.318 input

| FS1 | FS0 | CLK1 |
|-----|-----|------------|
| 0 | 0 | 25.057 MHz |
| 0 | 1 | 33.289 MHz |
| 1 | 0 | 40.006 MHz |
| 1 | 1 | 50.113 MHz |

Decoding Table for AV9108-11 (in MHz)

| FS3 | FS2 | FS1 | FS0 | CLK1 |
|-----|-----|-----|-----|------------|
| 0 | 0 | 0 | 0 | 16.00 MHz |
| 0 | 0 | 0 | 1 | 33.39 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 | 60.00 MHz |
| 0 | 1 | 1 | 1 | 4.01 MHz |
| 1 | 0 | 0 | 0 | 8.02 MHz |
| 1 | 0 | 0 | 1 | 20.05 MHz |
| 1 | 0 | 1 | 0 | 25.06 MHz |
| 1 | 0 | 1 | 1 | 39.99 MHz |
| 1 | 1 | 0 | 0 | 33.25 MHz |
| 1 | 1 | 0 | 1 | 50.11 MHz |
| 1 | 1 | 1 | 0 | 30.00 MHz |
| 1 | 1 | 1 | 1 | 4.01 MHz |

Note: The dash number following ICS9108 must be included when ordering product since it specifies the frequency decoding table being ordered. Decoding options can be created by a simple metal mask change.



AV9108

Frequency Accuracy and Calculation

The accuracy of the frequencies produced by the **ICS9108** 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 **ICS9108** can produce frequencies within 0.1% of the desired output.

Frequency Transitions

A key **ICS9108** feature is the ability to provide glitch-free frequency transitions across its output frequency range. The **ICS9108** 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

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

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.



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 | - | 6.0 | 16 | μA |
| Input High Current | I _{IH} | V _{IN} =V _{DD} | -2.0 | - | 2.0 | μA |
| Output Low Voltage | V _{OL} | I _{OL} =10mA | - | 0.15 | 0.40 | V |
| Output High Voltage, Note 1 | V _{OH} | I _{OH} =-30mA | 2.4 | 3.25 | - | V |
| Output Low Current, Note 1 | I _{OL} | V _{OL} =0.8V | 22.0 | 35.0 | - | mA |
| Output High Current, Note 1 | I _{OH} | V _{OH} =2.0V | - | -50.0 | -35.0 | mA |
| Supply Current | I _{CC} | Unload, 50 MHz | - | 18.0 | 42.0 | mA |
| Supply Current | I _{CC} (PD low) | Unload, Logic Inputs 000 | - | 38.0 | 100.0 | μA |
| Supply Current | I _{CC} (PD low) | Unload, Logic Inputs 111 | - | 14.0 | 40.0 | μA |
| Pull-up Resistor, Note 1 | R _{pu} | | - | 380.0 | 700.0 | k ohms |
| AC Characteristics | | | | | | |
| Rise Time 0.8 to 2.0V, Note 1 | T _r | 15pf load | - | 0.60 | 1.40 | ns |
| Fall Time 2.0 to 0.8V, Note 1 | T _f | 15pf load | - | 0.40 | 1.00 | ns |
| Rise Time 20% to 80%, Note 1 | T _r | 15pf load | - | 2.0 | 3.5 | ns |
| Fall Time 80% to 20%, Note 1 | T _f | 15pf load | - | 1.0 | 2.5 | ns |
| Duty Cycle, Note 1 | D _t | 15pf load @ 1.4V | 45.0 | 50.0 | 55.0 | % |
| Jitter, One Sigma, Note 1 | T _{jis} | From 20 to 100 MHz | - | 50.0 | 150.0 | ps |
| Jitter, One Sigma, Note 1 | T _{jis} | From 14 to 16 MHz | | 100.0 | 200.0 | ps |
| Jitter, One Sigma, Note 1 | T _{jis} | From 14 to Below | | 0.2 | 1.0 | % |
| Jitter, Absolute, Note 1 | T _{jab} | From 20 to 100 MHz | -250.0 | | 250.0 | ps |
| Jitter, Absolute, Note 1 | T _{jab} | From 14 to 16 MHz | -500.0 | | 500.0 | ps |
| Jitter, Absolute, Note 1 | T _{jab} | From 14 to Below | | 1.0 | 3.0 | % |
| Input Frequency, Note 1 | F _i | | 11.0 | 14.3 | 19.0 | MHz |
| Output Frequency | F _o | | 2.0 | - | 120.0 | MHz |
| Power-up Time, Note 1 | T _{pu} | | - | 7.58 | 18.0 | ms |
| Transition Time, Note 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.



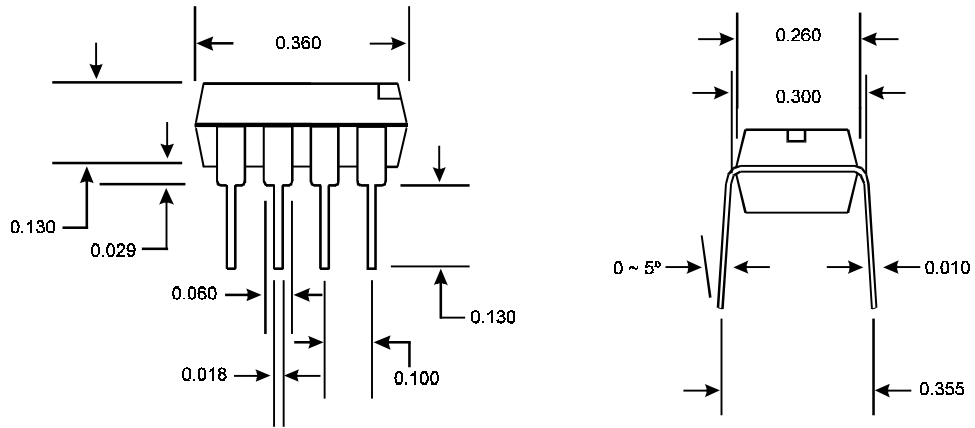
AV9108

Electrical Characteristics at 3.3V

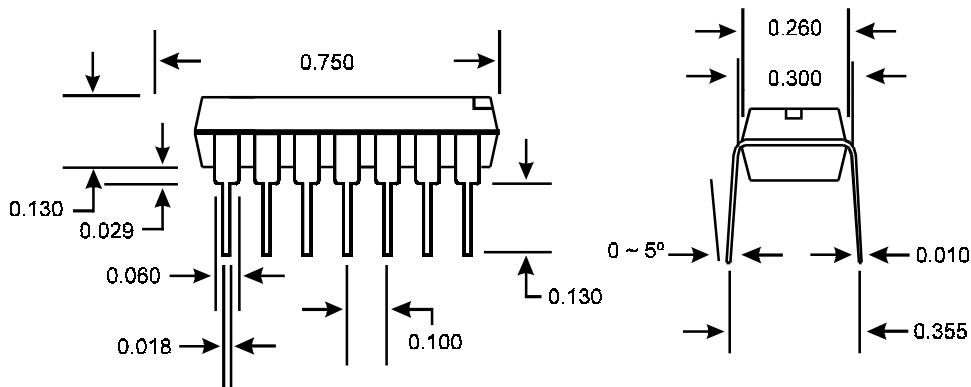
(Operating $V_{DD} = +3.0V$ to $+3.7V$; $T_A = 0^\circ C$ to $70^\circ C$ unless otherwise stated)

| 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} | $V_{IN}=0V$ | - | 2.5 | 7.0 | μA |
| Input High Current | I_{IH} | $V_{IN}=V_{DD}$ | -2.0 | - | 2.0 | μA |
| Output Low Voltage | V_{OL} | $I_{OL}=6mA$ | - | 0.15 | 0.1 | V |
| Output High Voltage | V_{OH} | $I_{OH}=-5mA$ | 0.85 | 0.92 | - | V |
| Output Low Current | I_{OL} | $V_{OL}=0.2V_{DD}$ | 15.0 | 22.0 | - | mA |
| Output High Current | I_{OH} | $V_{OL}=0.7V_{DD}$ | - | -17.0 | -10.0 | mA |
| Supply Current | I_{CC} | Unloaded, 50 MHz | - | 22.0 | 40.0 | mA |
| Supply Current | I_{CC} (PD low) | Unload, Logic Inputs 000 | - | 13.0 | 40.0 | μA |
| Supply Current | I_{CC} (PD low) | Unload, Logic Inputs 111 | - | 4.0 | 12.0 | μA |
| Pull-up Resistor | R_{pu} | | - | 550.0 | 900.0 | k ohms |
| AC Characteristics | | | | | | |
| Rise Time 20% to 80%, Note 1 | T_r | 15pf load | - | 2.2 | 3.5 | ns |
| Fall Time 80% to 20% | T_f | 15pf load | - | 1.2 | 2.5 | ns |
| Duty Cycle | D_t | 15pf load @ 50% | 40.0 | 46.0 | 60.0 | % |
| Jitter, One Sigma | T_{jis} | From 25 to 85 MHz | - | 50.0 | 150.0 | ps |
| Jitter, One Sigma | T_{jis} | From 14 to 20 MHz | - | 100.0 | 200.0 | ps |
| Jitter, One Sigma | T_{jis} | From 14 to Below | - | 0.4 | 1.0 | % |
| Jitter, Absolute | T_{jab} | From 25 to 85 MHz | -250.0 | - | 250.0 | ps |
| Jitter, Absolute | T_{jab} | From 14 to 20 MHz | -500.0 | - | 500.0 | ps |
| Jitter, Absolute | T_{jab} | From 14 to Below | - | 1.0 | 3.0 | % |
| Input Frequency | F_i | | 13.3 | 14.3 | 15.3 | MHz |
| Output Frequency | F_o | | 2.0 | - | 90.0 | MHz |
| Power-up Time, Note 1 | T_{pu} | | - | 7.58 | 18.0 | ms |
| Transition Time, Note 1 | T_{ft} | 8 to 66.6 MHz | - | 6.0 | 13.0 | ms |

Parameter is guaranteed by design and characterization.



8-Pin DIP Package



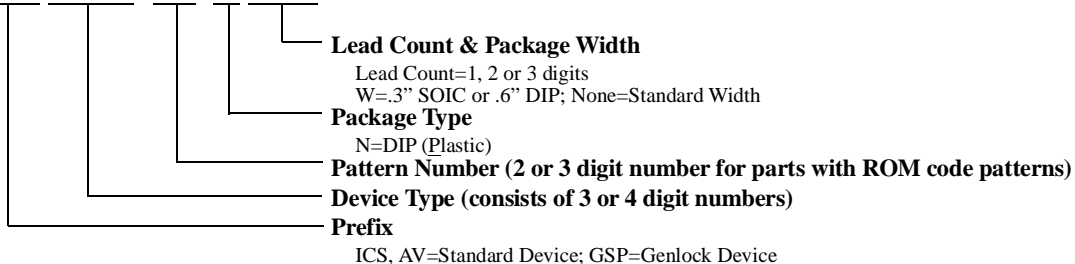
14-Pin DIP Package

Ordering Information

AV9108-XXCN8, ICS9108-XXCN14

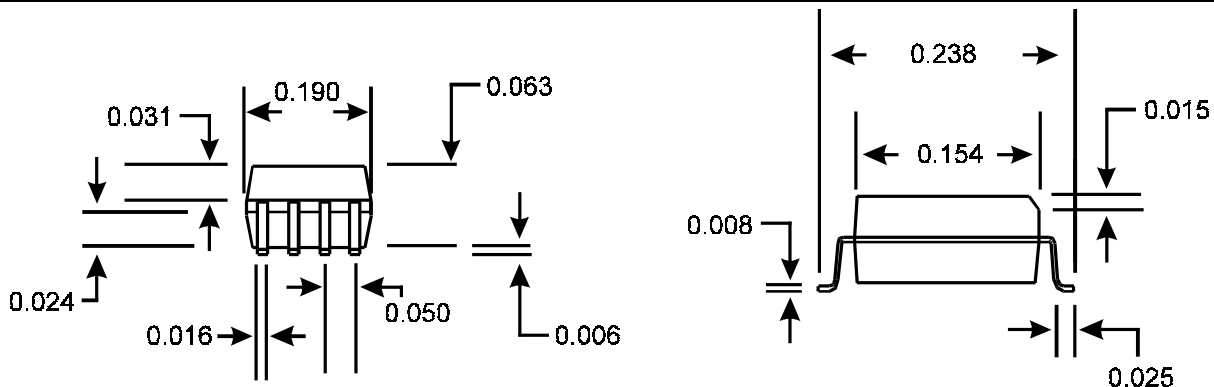
Example:

XXX XXXX- XX M X#W

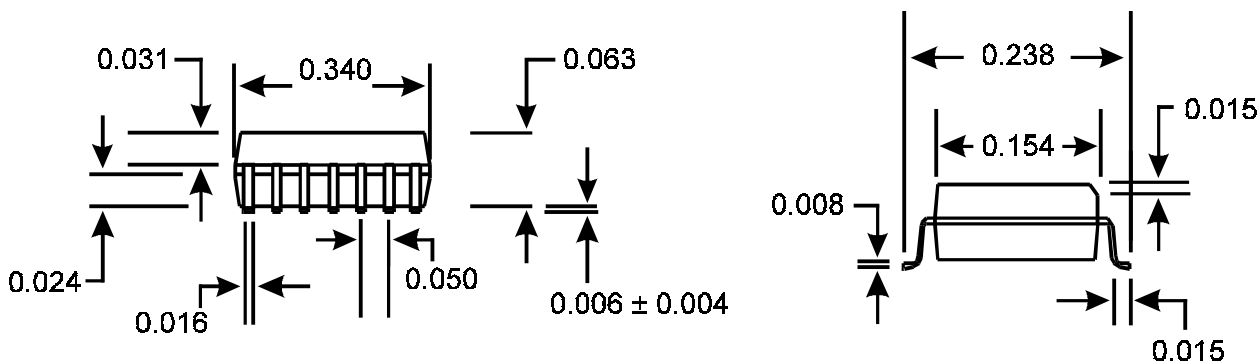




AV9108



8-Pin Plastic SOIC



14-Pin SOIC Package

Ordering Information

ICS9108-XXCS8, IS9108-XXCS14

Example:

XXX XXXX- XX M X#W

