



**Integrated  
Circuit  
Systems, Inc.**

**ICS9120-46**

## Modem and Audio Clock Generator

### General Description

The ICS9120-46 is a high performance frequency generator designed to support the clock requirements of communication and audio interfaces. It offers the clock frequencies required by 28.8 baud modem plus sound system. These frequencies are synthesized from 14.7456 MHz reference oscillator whose buffered output is available for the reference.

High accuracy, low-jitter PLLs meet the -96dB signal-to-noise ratios required by 16-bit audio systems. Fast output clock edge rates minimize board induced jitter.

The on-chip XTAL oscillator accuracy is better than  $\pm 100$ ppm for an AT cut, 18pF load crystal with initial accuracy of ppm plus TC, aging and load variation of  $\pm 20$ ppm each assuming 33pF  $\pm 5\%$  external load capacitors.

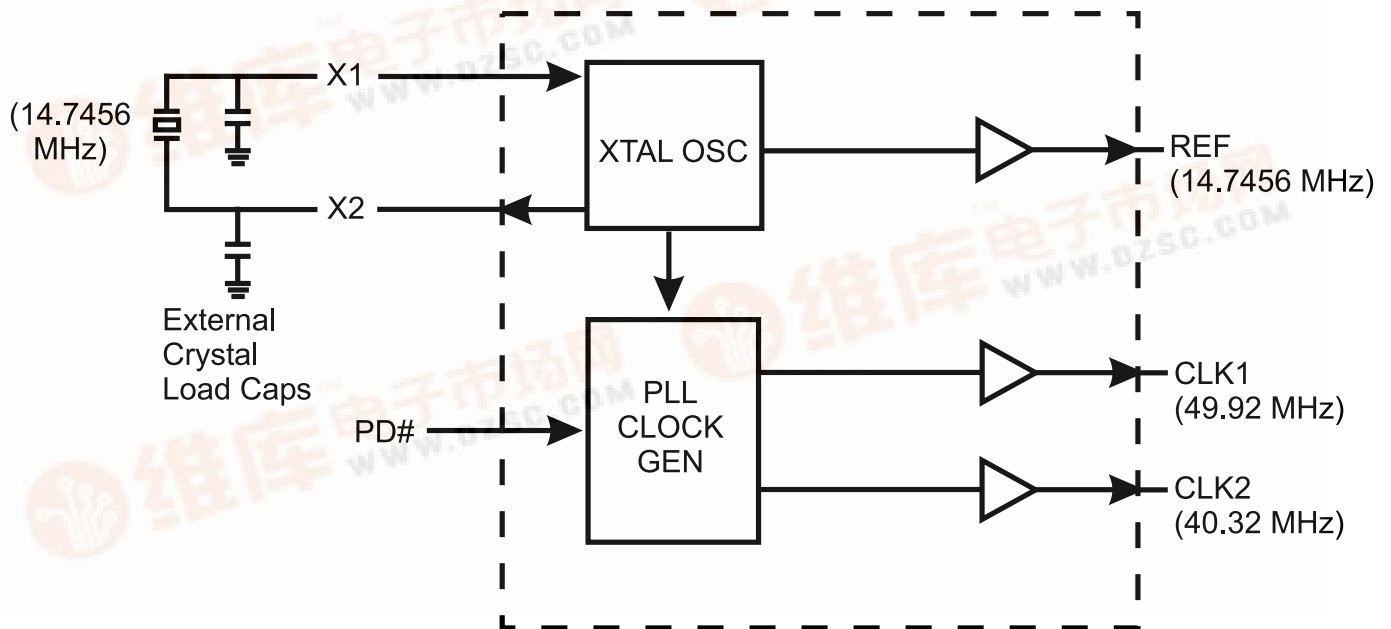
### Features

- Generates 49.92 MHz, 40.32 MHz and 14.7456 MHz
- Single 14.7456 MHz crystal reference
- 49.92 MHz accuracy tracks 40.32 MHz reference
- 80ps one sigma jitter maintains 16-bit performance
- Output rise/fall times less than 1.5ns
- On-chip loop filter components
- 3.0-5.5V supply range
- 8-pin, 150-mil SOIC package

### Applications

- Specifically designed to support the high performance requirements of communication and audio interfaces.

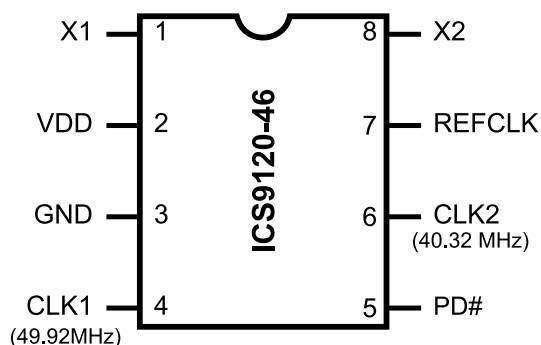
### Block Diagram





# ICS9120-46

## Pin Configuration



### 8-Pin SOIC

## Functionality

The **ICS9120-46** incorporates a crystal oscillator circuit designed to provide 50% duty cycle over a range of operating conditions, including the addition of external crystal load capacitors to pins X1 and X2.

For the crystal oscillator, the crystal load capacitance must be connected externally by adding a capacitor from each of the X1 and X2 pins to ground. A parallel resonant 14.7456 MHz crystal is recommended.

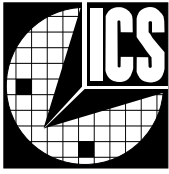
Duty cycle is also maintained when using an external clock source (connected to X1, X2 left unconnected) as long as the external clock has good duty cycle.

## Functionality

| X1 (MHz) | PD# | CLK1 (MHz) | CLK2 (MHz) | REF (MHz) |
|----------|-----|------------|------------|-----------|
| -        | 0   | Low        | Low        | Low       |
| 14.7456  | 1   | 49.92      | 40.32      | 14.7456   |

## Pin Descriptions for ICS9120-46

| PIN NUMBER | PIN NAME | TYPE   | DESCRIPTION  |
|------------|----------|--------|--|
| 1          | X1       | Input  | Crystal or external clock source. Has feedback bias for crystal. Nominally 14.7456<N>MHz input applied. (No internal load cap; must connect external load cap to ground for crystal oscillator.) |
| 2          | VDD      | Power  | +Power supply input.   |
| 3          | GND      | Power  | Ground return for Pin 2.   |
| 4          | CLK1     | Output | 49.92 MHz target output clock (with nominal 14.7456 MHz input).  |
| 5          | PD#      | Output | Power-down input. All outputs shut off and driven to low output state when this pin is at logic low level. Has pull-up.  |
| 6          | CLK2     | Output | 40.32 MHz target output clock.   |
| 7          | REF      | Output | 14.7456 MHz reference clock buffered output (with nominal 14.7456 MHz input).  |
| 8          | X2       | Output | Crystal output drive (leave this pin unconnected when using an external clock). (No internal load cap; must connect external load cap to ground for crystal oscillator).                         |



### 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

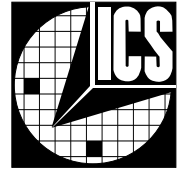
Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to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

### Electrical Characteristics at 5 V

V<sub>DD</sub> = +4.5 to +5.5V, T<sub>A</sub> = 0 to 70°C unless otherwise stated

| DC Characteristics        |                   |                                       |       |       |       |       |
|---------------------------|-------------------|---------------------------------------|-------|-------|-------|-------|
| PARAMETER                 | SYMBOL            | TEST CONDITIONS                       | MIN   | TYP   | MAX   | UNITS |
| Input Low Voltage         | V <sub>IL</sub>   |                                       | -     | -     | 0.8   | V     |
| Input High Voltage        | V <sub>IH</sub>   |                                       | 2.0   | -     | -     | V     |
| Input Low Current         | I <sub>IL</sub>   | V <sub>IN</sub> =0V                   | -18.0 | -8.3  | -     | µA    |
| Input High Current        | I <sub>IH</sub>   | V <sub>IN</sub> =V <sub>DD</sub>      | -     | -     | 5.0   | µA    |
| Output Low Voltage        | V <sub>OL</sub>   | I <sub>OL</sub> =+10mA                | -     | 0.15  | 0.4   | V     |
| Output High Voltage       | V <sub>OH</sub>   | I <sub>OH</sub> =-30mA                | 2.4   | 3.7   | -     | V     |
| Output Low Current        | I <sub>OL</sub>   | V <sub>OL</sub> =0.8V                 | 25.0  | 45.0  | -     | mA    |
| Output High Current       | I <sub>OH</sub>   | V <sub>OH</sub> =2.4V                 | -     | -53.0 | -35.0 | mA    |
| Supply Current            | I <sub>DD</sub>   | Unloaded                              | -     | 27.0  | 50.0  | mA    |
| Supply Current Power-down | I <sub>DDPD</sub> | Unloaded; Pin 5=0V                    | -     | 500.0 | 800.0 | µA    |
| Pull-up Resistor Value    | R <sub>pu</sub>   |                                       | -     | 400.0 | 800.0 | k ohm |
| AC Characteristics        |                   |                                       |       |       |       |       |
| Rise Time                 | T <sub>r</sub>    | 15pF load 0.8 to 2.0V                 | -     | 0.8   | 2.0   | ns    |
| Fall Time                 | T <sub>f</sub> *  | 15pF load 2.0 to 0.8V                 | -     | 0.6   | 1.5   | ns    |
| Rise Time                 | T <sub>r</sub>    | 15pF load 20% to 80%                  | -     | 1.7   | 3.0   | ns    |
| Fall Time                 | T <sub>f</sub>    | 15pF load 80% to 20%                  | -     | 1.1   | 2.5   | ns    |
| Duty Cycle                | D <sub>t</sub>    | 15pF load @ 50% of VDD; Except REFCLK | 45.0  | 50.0  | 55.0  | %     |
| Duty Cycle                | D <sub>t</sub>    | 15pF load @ 50% of VDD; REFCLK only   | 40.0  | 45.0  | 60.0  | %     |
| Jitter, One Sigma         | T <sub>jis</sub>  | For all frequencies except REFCLK     | -     | 70.0  | 90.0  | ps    |
| Jitter, Absolute          | T <sub>jab</sub>  | For all frequencies except REFCLK     | 300.0 | 270   | 300.0 | ps    |
| Jitter, One Sigma         | T <sub>jis</sub>  | REFCLK only                           | -     | 350.0 | 500.0 | ps    |
| Jitter Absolute           | T <sub>jab</sub>  | REFCLK only                           | -1.0  | 0.8   | 1.0   | ns    |
| Input Frequency Range     | F <sub>i</sub>    |                                       | 11.0  | 14.0  | 17.0  | MHz   |
| Output Frequency Range    | F <sub>o</sub>    |                                       | 11.0  | -     | 58.0  | MHz   |
| Power-up Time             | T <sub>pu</sub>   | 0 to 40.3 MHz                         | -     | 5.5   | 12.0  | ms    |
| Crystal Input Capacitance | C <sub>inx</sub>  | X1 (Pin 1), X2 (Pin 8)                | -     | 5     | -     | pF    |

\*Parameter is guaranteed by design and characterization. Not 100% tested in production.

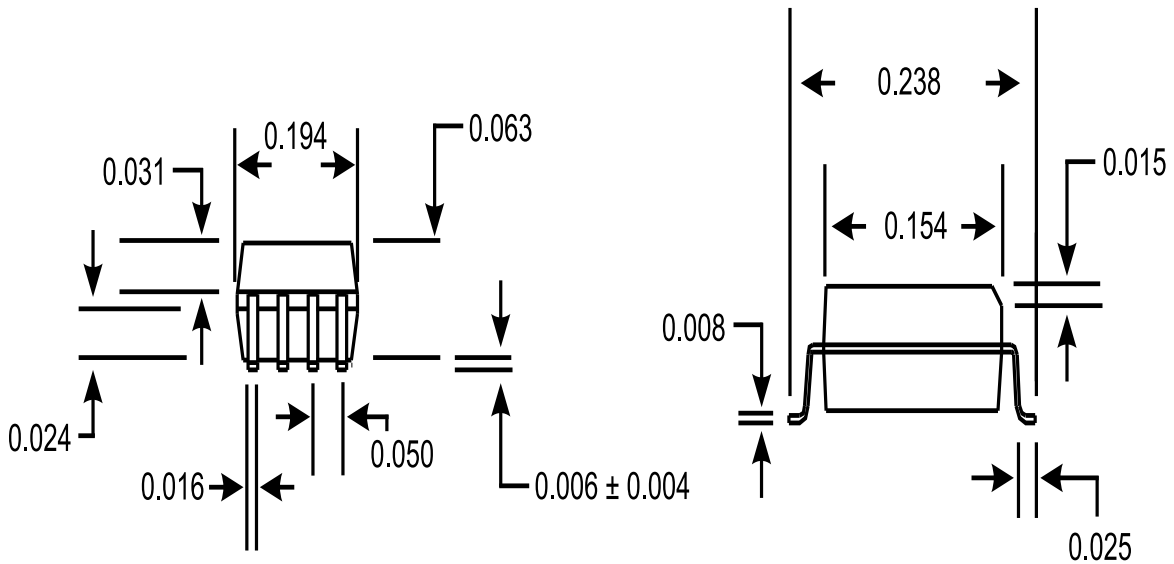
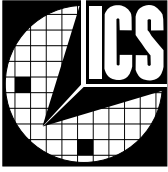


## Electrical Characteristics at 3.3 V

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

| DC Characteristics        |            |                                       |              |              |             |         |
|---------------------------|------------|---------------------------------------|--------------|--------------|-------------|---------|
| PARAMETER                 | SYMBOL     | TEST CONDITIONS                       | MIN          | TYP          | MAX         | UNITS   |
| Input Low Voltage         | $V_{IL}$   |                                       | -            | -            | $0.2V_{DD}$ | V       |
| Input High Voltage        | $V_{IH}$   |                                       | $0.7V_{DD}$  | -            | -           | V       |
| Input Low Current         | $I_{IL}$   | $V_{IN}=0V$                           | -8.0         | -3.6         | -           | $\mu A$ |
| Input High Current        | $I_{IH}$   | $V_{IN}=V_{DD}$                       | -            | -            | 5.0         | $\mu A$ |
| Output Low Voltage        | $V_{OL}$   | $I_{OL}=6.0mA$                        | -            | $0.05V_{DD}$ | 1.1         | V       |
| Output High Voltage       | $V_{OH}$   | $I_{OH}=4.0mA$                        | $0.85V_{DD}$ | $0.94V_{DD}$ | -           | V       |
| Output Low Current        | $I_{OL}$   | $V_{OL}=0.2V_{DD}$                    | 15.0         | 24.0         | -           | mA      |
| Output High Current       | $I_{OH}$   | $V_{OH}=0.7V_{DD}$                    | -            | -13.0        | -8.0        | mA      |
| Supply Current            | $I_{DD}$   | Unloaded                              | -            | 20.0         | 40.0        | mA      |
| Supply Current Power-down | $I_{DDPD}$ | Unloaded; Pin 5=0V                    | -            | 200.0        | 400.0       | $\mu A$ |
| Pull-up Resistor Value    | Rpu        |                                       | -            | 620.0        | 900.0       | k ohm   |
| AC Characteristics        |            |                                       |              |              |             |         |
| Rise Time                 | $T_r$      | 15pF load 0.8 to 2.0V                 | -            | 2.2          | 3.5         | ns      |
| Fall Time                 | $T_f^*$    | 15pF load 2.0 to 0.8V                 | -            | 1.2          | 2.5         | ns      |
| Rise Time                 | $T_r$      | 15pF load 20% to 80%                  | -            | 2.3          | 4.0         | ns      |
| Fall Time                 | $T_f$      | 15pF load 80% to 20%                  | -            | 1.2          | 3.0         | ns      |
| Duty Cycle                | $D_t$      | 15pF load @ 50% of VDD; Except REFCLK | 45.0         | 50.0         | 55.0        | %       |
| Duty Cycle                | $D_t$      | 15pF load @ 50% of VDD; REFCLK only   | 40.0         | 45.0         | 60.0        | %       |
| Jitter, One Sigma         | $T_{j1s}$  | For all frequencies except REFCLK     | -            | 80.0         | 100.0       | ps      |
| Jitter Absolute           | $T_{jab}$  | For all frequencies except REFCLK     | -350.0       | $\pm 300.0$  | 350.0       | ps      |
| Jitter, One Sigma         | $T_{j1s}$  | REFCLK only                           | -            | 380.0        | 500.0       | ps      |
| Jitter, Absolute          | $T_{jab}$  | REFCLK only                           | -1.0         | 0.8          | 1.0         | ns      |
| Input Frequency Range     | $F_i$      |                                       | 11.0         | 14.745       | 15.0        | MHz     |
| Output Frequency Range    | $F_o$      |                                       | 14.0         | -            | 51.0        | MHz     |
| Power-up Time             | $T_{pu}$   | 0 to 40.3 MHz                         | -            | 5.5          | 12.0        | ms      |
| Crystal Input Capacitance | $C_{inx}$  | X1 (Pin 1), X2 (Pin 8)                | -            | 5            | -           | pF      |

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8 Pin SOIC Package

### Ordering Information

ICS9120M-46

Example:

**ICS XXXX M-PPP**

