



# Frequency Generator for Fibre Channel Systems

## General Description

The ICS9112-31/32 are high-speed clock generators designed to support fibre channel system requirements. The ICS9112-31/32 generates 106.25 MHz from a 25 MHz crystal.

An exact frequency multiplying ratio ensures better than  $\pm 100$  ppm frequency accuracy using a standard AT crystal with external load capacitors (typically 33pF  $\pm 5\%$  for an 18pF load crystal). Achieving  $\pm 100$  ppm over four years requires the crystal to have a  $\pm 20$  ppm initial accuracy,  $\pm 30$  ppm temperature and  $\pm 5$  ppm/year aging coefficients.

The ICS9112-31/32 with less than 25ps accumulative jitter is well suited for Fibre Channel applications.

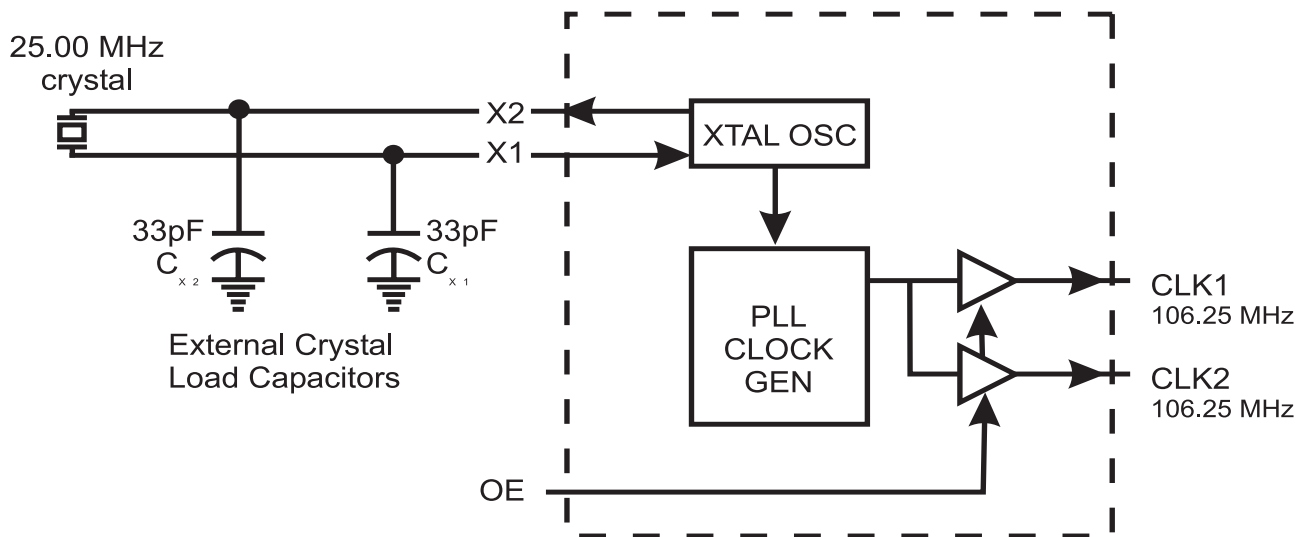
## Features

- Generates 106.25 MHz clocks from a 25 MHz crystal
- Less than 45ps one sigma jitter (15ps typ.)
- Less than  $\pm 130$ ps absolute jitter
- Less than 25ps accumulative jitter @ 256 cycles
- Rise/fall times less than 1.2ns driving 15pF
- On-chip loop filter components
- 3.0V-5.5V supply range
- 8-pin, 150-mil SOIC package

## Applications

- Specifically designed to support the high-speed clocking requirements of fibre channel systems.

## Block Diagram

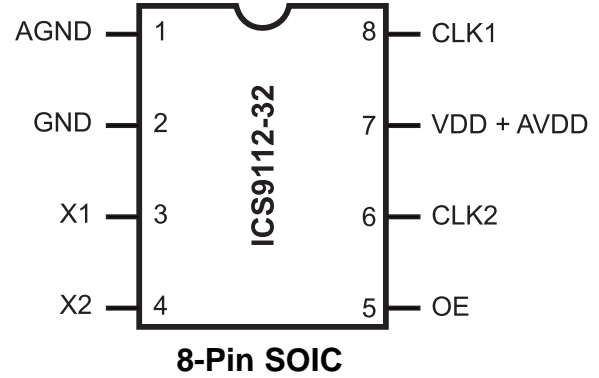
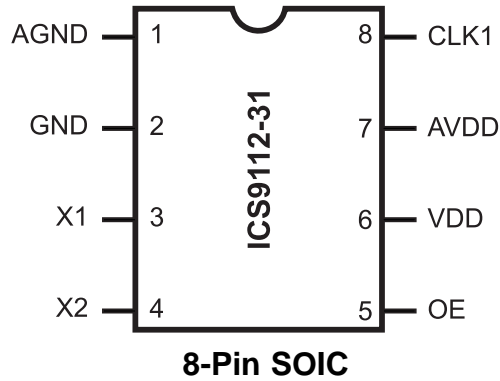


# ICS9112-31/32



## Preliminary Product Preview

### Pin Configurations



### Functionality

| OE | X1, X2 (MHz) | FOUT (MHz) |
|----|--------------|------------|
| 1  | 25.00        | 106.25     |
| 0  | 25.00        | Tristate   |

### Pin Descriptions

| PIN NUMBER | PIN NAME | TYPE | DESCRIPTION   |
|------------|----------|------|---|
| 1          | AGND     | PWR  | Analog ground.  |
| 2          | GND      | PWR  | Digital Ground.   |
| 3          | X1       | IN   | Crystal or clock input to device; nominally 25.00 MHz. Requires external load capacitors.   |
| 4          | X2       | IN   | Crystal drive output from device. Requires external load capacitors.                        |
| 5          | OE       | IN   | Output Enable (has internal pull_up.): when OE is low, it tristates the clock output (FOUT) |
| 6          | VDD      | PWR  | +3.3 or +5.0 volt supply (-31)  |
|            | CLK2     | OUT  | Clock output (106.25MHz) (-32)  |
| 7          | AVDD     | PWR  | Analog power. (Must equal digital power voltage).(-31)                                      |
|            | VDD+AVDD | PWR  | Digital and analog power, +3.3 or +5.0Volt supply (-32)                                     |
| 8          | CLK1     | OUT  | Clock output (106.25MHz)  |



### 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 5.0V

Operating VDD = +4.5V to +5.5V; TA =0°C 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 (Pull-up input) | -16.0  | -6.0   | -     | µA     |
| Input High Current                     | I <sub>IH</sub>   | V <sub>IN</sub> =V <sub>DD</sub>    | -2.0   | -      | 2.0   | µA     |
| Output Low Voltage <sup>1</sup>        | V <sub>OL</sub>   | I <sub>OL</sub> =10mA               | -      | 0.15   | 0.40  | V      |
| Output High Voltage <sup>1</sup>       | V <sub>OH</sub>   | I <sub>OH</sub> =-30mA              | 2.4    | 3.25   | -     | V      |
| Output Low Current <sup>1</sup>        | I <sub>OL</sub>   | V <sub>OL</sub> =0.8V               | 22.0   | 35.0   | -     | mA     |
| Output High Current <sup>1</sup>       | I <sub>OH</sub>   | V <sub>OH</sub> =2.0V               | -      | -50.0  | -35.0 | mA     |
| Supply Current                         | I <sub>DD</sub>   | Unloaded                            | -      | 22.0   | 45.0  | mA     |
| Pull-up Resistor <sup>1</sup>          | R <sub>pu</sub>   |                                     | -      | 100    | -     | k ohms |
| AC Characteristics                     |                   |                                     |        |        |       |        |
| Rise Time <sup>1</sup>                 | T <sub>rl</sub>   | 15pF load, 0.8 to 2.0V              | -      | 0.8    | 1.2   | ns     |
| Fall Time <sup>1</sup>                 | T <sub>fl</sub>   | 15pF load, 2.0 to 0.8V              | -      | 0.7    | 1.2   | ns     |
| Duty Cycle <sup>1</sup>                | D <sub>t</sub>    | 15pF load @ 1.4V                    | 42.0   | 49.0   | 55.0  | %      |
| Jitter, One Sigma <sup>1</sup>         | T <sub>j1s</sub>  | 15pF load                           | -      | 15.0   | 45.0  | ps     |
| Jitter, Absolute <sup>1</sup>          | T <sub>jab</sub>  | 15pF load                           | -130.0 | -      | 130.0 | ps     |
| Accumulative Jitter <sup>1</sup>       | T <sub>jacc</sub> | 15pF load @ 256 Cycle               | -      | 17.0   | -     | ps     |
| Input Frequency <sup>1</sup>           | F <sub>i</sub>    |                                     | -      | 25.0   | -     | MHz    |
| Output Frequency <sup>1</sup>          | F <sub>o</sub>    |                                     | -      | 106.25 | -     | MHz    |
| Power-up Time <sup>1</sup>             | T <sub>pu</sub>   |                                     | -      | 7.58   | 18.0  | ms     |
| Crystal Input Capacitance <sup>1</sup> | C <sub>inx</sub>  | X1 (Pin 1)<br>X2 (Pin 8)            | -      | 3.0    | -     | pF     |

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



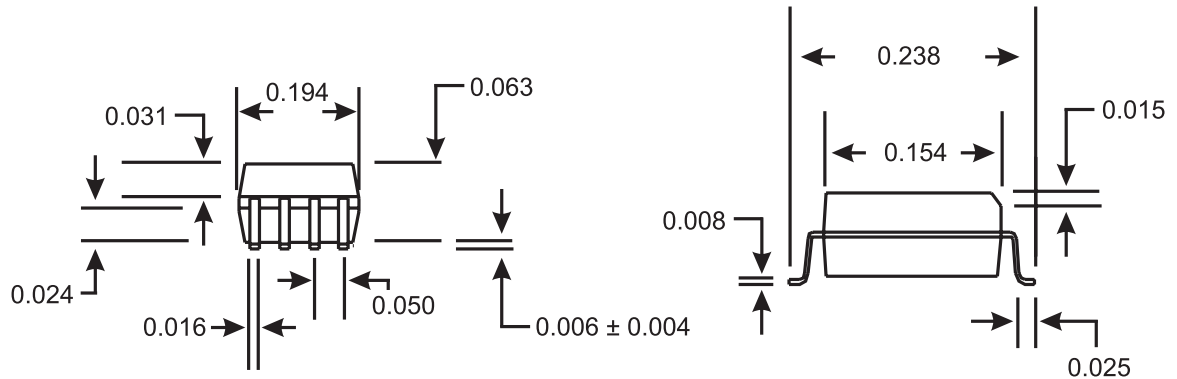
## Preliminary Product Preview

### 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         | -            | $\mu A$ |
| Input High Current                     | $I_{IH}$   | $V_{IN}=V_{DD}$             | -2.0         | -            | 2.0          | $\mu A$ |
| Output Low Voltage <sup>1</sup>        | $V_{OL}$   | $I_{OL}=6mA$                | -            | $0.05V_{DD}$ | $0.1V_{DD}$  | V       |
| Output High Voltage <sup>1</sup>       | $V_{OH}$   | $I_{OH}=-5mA$               | $0.85V_{DD}$ | $0.92V_{DD}$ | -            | V       |
| Output Low Current <sup>1</sup>        | $I_{OL}$   | $V_{OL}=0.2V_{DD}$          | 15.0         | 22.0         | -            | mA      |
| Output High Current <sup>1</sup>       | $I_{OH}$   | $V_{OH}=0.7V_{DD}$          | -            | -17.0        | -10.0        | mA      |
| Supply Current                         | $I_{DD}$   | Unloaded                    | -            | 14.0         | 30.0         | mA      |
| Pull-up Resistor <sup>1</sup>          | $R_{pu}$   |                             | -            | 175.0        | -            | k ohms  |
| AC Characteristics                     |            |                             |              |              |              |         |
| Rise Time <sup>1</sup>                 | $T_{r1}$   | 15pF load, 0.8 to 2.0V      | -            | 0.65         | 1.2          | ns      |
| Fall Time <sup>1</sup>                 | $T_{f1}$   | 15pF load, 2.0 to 0.8V      | -            | 0.6          | 1.2          | ns      |
| Duty Cycle <sup>1</sup>                | $D_t$      | 15pF load @ 1.4V            | 40.0         | 50.0         | 60.0         | %       |
| Jitter, One Sigma <sup>1</sup>         | $T_{j1s}$  | 15pF load                   | -            | 15.0         | 45.0         | ps      |
| Jitter, Absolute <sup>1</sup>          | $T_{jab}$  | 15pF load                   | -130.0       | -            | 130.0        | ps      |
| Accumulative Jitter <sup>1</sup>       | $T_{jacc}$ | 15pF load @ 256 cycle       | -            | 17.0         | -            | ps      |
| Input Frequency <sup>1</sup>           | $F_i$      |                             | -            | 25.0         | -            | MHz     |
| Output Frequency <sup>1</sup>          | $F_o$      |                             | -            | 106.25       | -            | MHz     |
| Power-up Time <sup>1</sup>             | $T_{pu}$   |                             | -            | 7.58         | 18.0         | ms      |
| Crystal Input Capacitance <sup>1</sup> | $C_{inx}$  | X1 (Pin 1)<br>X2 (Pin 8)    | -            | 3.0          | -            | pF      |

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



8-Pin Plastic SOIC Package

### Ordering Information

ICS9112M-31/32

Example:

**ICS XXXX M-PPP**

