



# MK3732-08 ADSL Clock Source

## Description

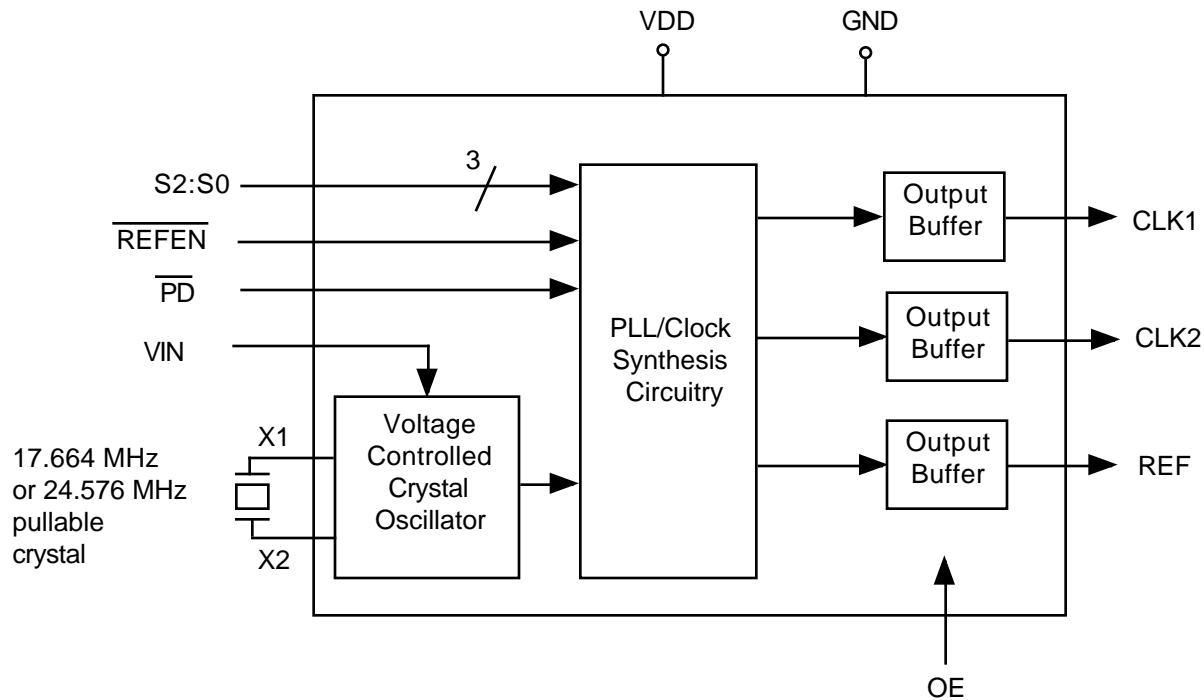
The MK3732-08 is a low cost, low jitter, high performance VCXO and PLL clock synthesizer designed to replace expensive discrete VCXOs and multipliers. The on-chip Voltage Controlled Crystal Oscillator (VCXO) accepts a 0 to 3.3 V input voltage to cause the output clocks to vary by  $\pm 100$  ppm. Using ICS/MicroClock's patented VCXO and analog/digital Phase-Locked Loop (PLL) techniques, the device uses an inexpensive 17.664 MHz or 24.576 MHz pullable crystal input to produce one or two output clocks.

ICS manufactures the largest variety of xDSL clock synthesizers for all applications. Consult ICS to eliminate VCXOs, crystals and oscillators from your board.

## Features

- Packaged in 20 pin SSOP (QSOP)
- Replaces a VCXO and oscillator
- Uses an inexpensive pullable crystal
- On-chip patented VCXO with pull range of 230 ppm ( $\pm 115$  ppm) minimum
- VCXO tuning voltage of 0 to 3.3 V
- Advanced, low power, sub-micron CMOS process
- 3.3V operating voltage
- Available in industrial temperature range

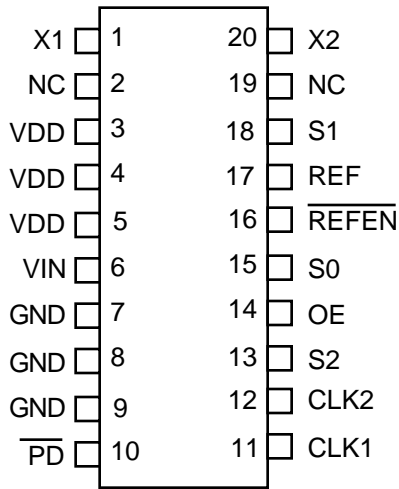
## Block Diagram





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## Pin Assignment



20 pin (150 mil) SSOP

## Clock Select Table

| S2 | S1 | S0 | Input    | CLK1   | CLK2   |
|----|----|----|----------|--------|--------|
| 0  | 0  | 0  | 24.576 * | 2.208  | OFF    |
| 0  | 0  | M  | 17.664   | 20.00  | OFF    |
| 0  | 0  | 1  | 17.664   | 20.19  | 35.328 |
| 0  | 1  | 0  | 17.664   | 70.66  | 35.328 |
| 0  | 1  | M  | 17.664   | 70.66  | 35.328 |
| 0  | 1  | 1  | 17.664   | 58.88  | 35.328 |
| 1  | 0  | 0  | 17.664   | 35.328 | 52.992 |
| 1  | 0  | M  | 17.664   | 2.208  | 35.328 |
| 1  | 0  | 1  | 17.664   | 20.19  | OFF    |
| 1  | 1  | 0  | 17.664   | 4.04   | 35.328 |
| 1  | 1  | M  | 17.664   | 35.328 | 61.82  |
| 1  | 1  | 1  | 17.664   | 35.328 | 56.52  |

0=connect directly to GND; M=leave unconnected (floating);  
1=connect directly to VDD

\* In this mode, 12.288 MHz is present on REF

## Pin Descriptions

| Number  | Name                      | Type  | Description  |
|---------|---------------------------|-------|--|
| 1       | X1                        | XI    | Crystal connection. Connect to a pullable crystal of 17.664 MHz or 24.576 MHz..        |
| 2, 19   | NC                        | -     | No Connect. Do not connect anything to this pin.                                       |
| 3, 4, 5 | VDD                       | P     | Power Supply. Connect to +3.3V.  |
| 6       | VIN                       | VI    | Voltage Input to VCXO. Zero to 3.3V signal which controls the VCXO frequency.          |
| 7, 8, 9 | GND                       | P     | Connect to ground.   |
| 10      | $\overline{\text{PD}}$    | I(PU) | Power Down active low. Turns entire chip off, clocks stop low.                         |
| 11      | CLK1                      | O     | Clock Output #1 per table above.   |
| 12      | CLK2                      | O     | Clock Output #2 per table above.   |
| 13      | S2                        | I(PU) | Select input #2. Selects outputs per table above.                                      |
| 14      | OE                        | I(PU) | Output Enable. Tri-states outputs when low.  |
| 15      | S0                        | TI    | Select input #0. Selects outputs per table above.                                      |
| 16      | $\overline{\text{REFEN}}$ | I(PU) | Reference Clock Enable. Enables REF Output when low. Connect to VDD for lowest jitter. |
| 17      | REF                       | O     | Reference Clock Output. This is the crystal oscillator output clock.                   |
| 18      | S1                        | I(PU) | Select input #1. Selects outputs per table above.                                      |
| 20      | X2                        | XO    | Crystal connection. Connect to a pullable crystal of 17.664 MHz or 24.576 MHz.         |

Key: I(PU) = Input with internal pull-up resistor; TI = Tri-level Input; O = Output; P = Power Supply Connection;  
VI = Analog Voltage Input; XI, XO = Crystal Pins.

## External Components

The MK3732-08 requires a minimum number of external components for proper operation. Decoupling capacitors of 0.01 $\mu$ F should be connected between VDD and GND pins 3 and 7, pins 4 and 8, and pins 5 and 9, as close to the MK3732-08 as possible. A series termination resistor of 33  $\Omega$  may be used for each clock output. The input crystal must be connected as close to the chip as possible. The input crystal should be a fundamental mode, parallel resonant, pullable, AT cut.

Consult ICS for recommended suppliers. IMPORTANT - Consult the Application Note MAN05 for layout guidelines.



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## Electrical Specifications

| Parameter   | Conditions            | Minimum  | Typical | Maximum | Units  |
|---|-----------------------|----------|---------|---------|--------|
| <b>ABSOLUTE MAXIMUM RATINGS (note 1)</b>            |                       |          |         |         |        |
| Supply voltage, VDD                                 | Referenced to GND     |          |         | 7       | V      |
| Inputs and Clock Outputs                            | Referenced to GND     | -0.5     |         | VDD+0.5 | V      |
| Ambient Operating Temperature                       | Commercial version    | 0        |         | 70      | °C     |
|   | Industrial version    | -40      |         | 85      | °C     |
| Soldering Temperature                               | Max of 10 seconds     |          |         | 260     | °C     |
| Storage temperature                                 |                       | -65      |         | 150     | °C     |
| <b>DC CHARACTERISTICS (VDD = 3.3V unless noted)</b> |                       |          |         |         |        |
| Core Operating Voltage, VDD                         |                       | 3.14     | 3.3     | 3.46    | V      |
| Input High Voltage, VIH, binary inputs              |                       | 2        |         |         | V      |
| Input Low Voltage, VIL, binary inputs               |                       |          |         | 0.8     | V      |
| Input High Voltage, VIH, trinary input              | S0, pin 15            | VDD-0.5  |         |         | V      |
| Input Low Voltage, VIL, trinary input               | S0, pin 15            |          |         | 0.5     | V      |
| Output High Voltage, VOH                            | IOH=-12mA             | 2.4      |         |         | V      |
| Output Low Voltage, VOL                             | IOL=12mA              |          |         | 0.4     | V      |
| Output High Voltage, VOH, CMOS level                | IOH=-4mA              | VDD -0.4 |         |         | V      |
| Operating Supply Current, IDD                       | No Load               |          | 19      |         | mA     |
| Short Circuit Current                               | Each output           |          | ±50     |         | mA     |
| Input Capacitance                                   | S2:S0, OE             |          | 5       |         | pF     |
| Frequency synthesis error                           | Both clocks           |          |         | 0       | ppm    |
| VIN, VCXO control voltage                           |                       | 0        |         | 3.3     | V      |
| <b>AC CHARACTERISTICS (VDD = 3.3V unless noted)</b> |                       |          |         |         |        |
| Input Crystal Frequency                             |                       | 17.664   |         | 24.576  | MHz    |
| Output Clock Frequency                              |                       | 2.208    |         | 70.656  | MHz    |
| Output Clock Rise Time                              | 0.8 to 2.0V           |          |         | 1.5     | ns     |
| Output Clock Fall Time                              | 2.0 to 0.8V           |          |         | 1.5     | ns     |
| Output Clock Duty Cycle                             | At VDD/2              | 40       |         | 60      | %      |
| Maximum Absolute Short Term Jitter                  | 15 pF load at output  |          | ±125    |         | ps     |
| Phase Noise, relative to carrier                    | 10 kHz offset, no REF |          | -115    |         | dBc/Hz |
| Output pullability, note 2                          | 0V < VIN < 3.3V       | ±115     |         |         | ppm    |

Notes: 1. Stresses beyond those listed under Absolute Maximum Ratings could cause permanent damage to the device. Prolonged exposure to levels above the operating limits but below the Absolute Maximums may affect device reliability.  
2. With an ICS approved pullable crystal.

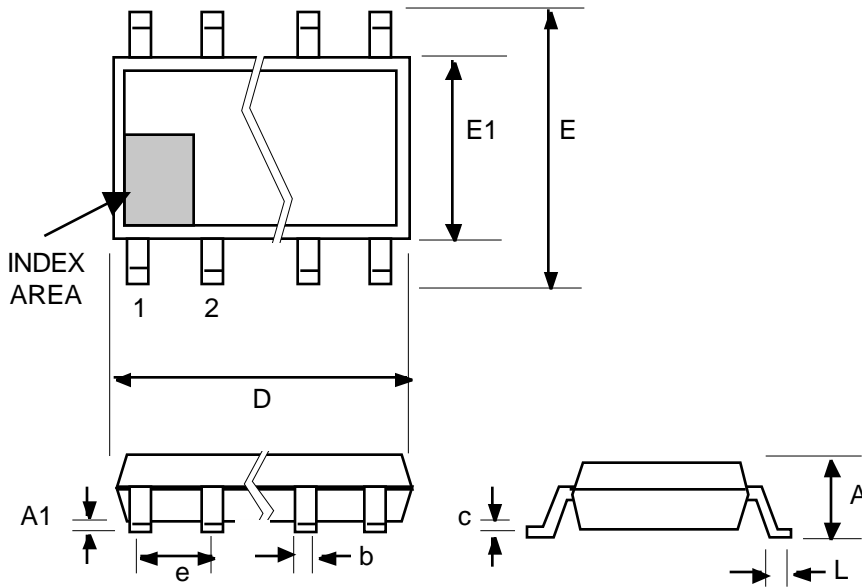
### Pullable Crystal Specifications:

|                                  |                            |
|----------------------------------|----------------------------|
| Correlation (load) Capacitance   | 14 pF                      |
| C0/C1                            | 250 max                    |
| ESR                              | 35 max                     |
| Operating Temperature            | 0 to 70 °C or -40 to 85 °C |
| Initial Accuracy                 | ±20 ppm                    |
| Temperature plus Aging Stability | ±50 ppm                    |



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## Package Outline and Package Dimensions (For current dimensional specifications, see JEDEC Publication No. 95.)



### 20 pin SSOP

| Symbol | Inches   |       | Millimeters |      |
|--------|----------|-------|-------------|------|
|        | Min      | Max   | Min         | Max  |
| A      | 0.053    | 0.069 | 1.35        | 1.75 |
| A1     | 0.004    | 0.010 | 0.10        | 0.25 |
| b      | 0.008    | 0.012 | 0.20        | 0.30 |
| c      | 0.007    | 0.010 | 0.19        | 0.25 |
| D      | 0.337    | 0.344 | 8.56        | 8.74 |
| e      | .025 BSC |       | 0.635 BSC   |      |
| E      | 0.228    | 0.244 | 5.79        | 6.20 |
| E1     | 0.150    | 0.157 | 3.81        | 3.99 |
| L      | 0.016    | 0.050 | 0.41        | 1.27 |

## Ordering Information

| Part/Order Number | Marking     | Shipping packaging | Package     | Temperature  |
|-------------------|-------------|--------------------|-------------|--------------|
| MK3732-08R        | MK3732-08R  | tubes              | 20 pin SSOP | 0 to 70 °C   |
| MK3732-08RTR      | MK3732-08R  | tape and reel      | 20 pin SSOP | 0 to 70 °C   |
| MK3732-08RI       | MK3732-08RI | tubes              | 20 pin SSOP | -40 to 85 °C |
| MK3732-08RITR     | MK3732-08RI | tape and reel      | 20 pin SSOP | -40 to 85 °C |

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