

## Helping Customers Innovate, Improve & Grow



# CD-700

## Description

The VI CD-700 is a user-configurable crystal based PLL integrated circuit. It includes a digital phase detector, op-amp, VCXO and additional integrated functions for use in digital synchronization applications. Loop filter software is available as well SPICE models for circuit simulation.

## Features

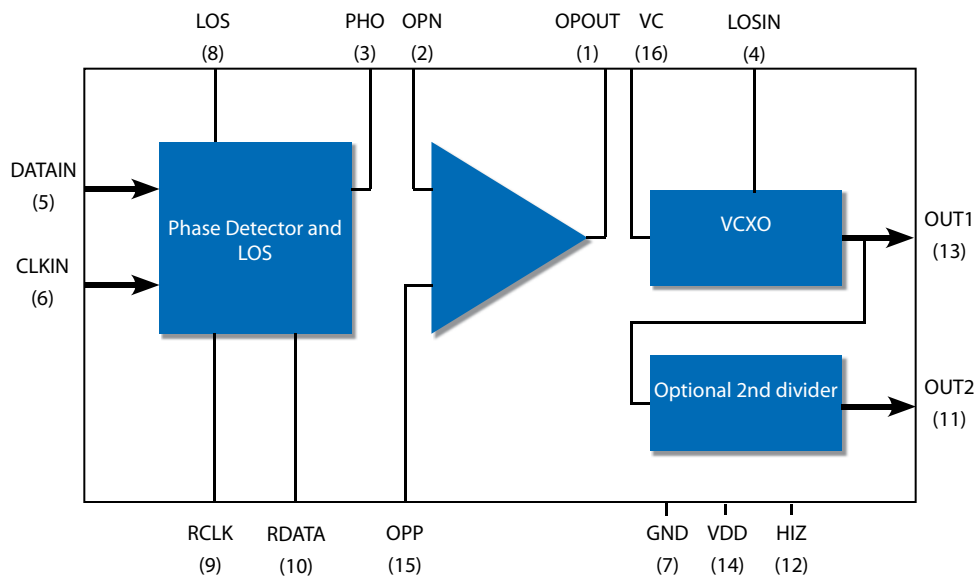
- 5 x 7.5 x 2 mm, smallest VCXO PLL available
- Output Frequencies to 77.76 MHz
- 5.0 or 3.3 Vdc operation
- Tri-State Output
- Holdover on Loss of Signal Alarm
- VCXO with CMOS outputs
- 0/70 or -40/85 °C temperature range
- Hermetically sealed ceramic SMD package
- Product is compliant to RoHS directive



## Applications

- Frequency Translation
- Clock Smoothing, Clock Switching
- NRZ Clock recovery
- DSLAM, ADM, ATM, Aggregation, Optical Switching/Routing,
- Base Station
- Synchronous Ethernet
- Low jitter PLL's

## Block Diagram



## Performance Specifications

Table 1. Electrical Performance

| Parameter                                                                                                           | Symbol               | Min                               | Typical    | Maximum                 | Units          |
|---------------------------------------------------------------------------------------------------------------------|----------------------|-----------------------------------|------------|-------------------------|----------------|
| Output Frequency ( <i>ordering option</i> )<br>OUT 1, 5.0 V option<br>OUT 1, 3.3 V option                           |                      | 1.000<br>1.000                    |            | 77.760<br>77.760        | MHz<br>MHz     |
| Supply Voltage <sup>1</sup><br>+5.0<br>+3.3                                                                         | $V_{DD}$             | 4.5<br>2.97                       | 5.0<br>3.3 | 5.5<br>3.63             | V<br>V         |
| Supply Current                                                                                                      | $I_{DD}$             |                                   |            | 63                      | mA             |
| Output Logic Levels<br>Output Logic High <sup>2</sup><br>Output Logic Low <sup>2</sup>                              | $V_{OH}$<br>$V_{OL}$ | 2.5                               |            | 0.5                     | V<br>V         |
| Output Transition Times<br>Rise Time <sup>2</sup><br>Fall Time <sup>2</sup>                                         | $t_R$<br>$t_F$       |                                   |            | 3.0<br>3.0              | ns<br>ns       |
| Input Logic Levels<br>Input Logic High <sup>2</sup><br>Input Logic Low <sup>2</sup>                                 | $V_{IH}$<br>$V_{IL}$ | 2.0                               |            | 0.5                     | V<br>V         |
| Loss of Signal Indication<br>Output Logic High <sup>2</sup><br>Output Logic Low <sup>2</sup>                        | $V_{OH}$<br>$V_{OL}$ | 2.5                               |            | 0.5                     | V<br>V         |
| Nominal Frequency on Loss of Signal<br>Output 1<br>Output 2                                                         |                      |                                   |            | $\pm 75$<br>$\pm 75$    | ppm<br>ppm     |
| Symmetry or Duty Cycle <sup>3</sup><br>Out 1<br>Out 2<br>RCLK                                                       | SYM1<br>SYM2<br>RCLK |                                   |            | 40/60<br>45/55<br>40/60 | %<br>%<br>%    |
| Absolute Pull Range ( <i>ordering option</i> )<br>over operating temperature, aging, and power<br>supply variations | APR                  | $\pm 50$<br>$\pm 80$<br>$\pm 100$ |            |                         | ppm            |
| Test Conditions for APR (+5.0 V option)                                                                             | $V_C$                | 0.5                               |            | 4.5                     | V              |
| Test Conditions for APR (+3.3 V option)                                                                             | $V_C$                | 0.3                               |            | 3.0                     | V              |
| Gain Transfer                                                                                                       | Kv                   | Positive                          |            |                         |                |
| Phase Detector Gain<br>+5.0 V option<br>+3.3 V option                                                               | Kv                   | 0.53<br>0.35                      |            |                         | rad/V<br>rad/V |
| Operating temperature ( <i>ordering option</i> )                                                                    | $T_{OP}$             | 0/70 or -40/85                    |            |                         | °C             |
| Control Voltage Leakage Current                                                                                     | $I_{VCXO}$           |                                   |            | $\pm 1.0$               | $\mu A$        |

1. A 0.01 $\mu F$  and 0.1 $\mu F$  parallel capacitor should be located as close to pin 14 as possible (and grounded).

2. Figure 2 defines these parameters. Figure 3 illustrates the equivalent five gate TTL load and operating conditions under which these parameters are tested and specified. Loads greater than 15 pF will adversely effect rise/fall time as well as symmetry.

3. Symmetry is defined as (ON TIME/PERIOD with  $V_S=1.4$  V for both 5.0 V and 3.3 V operation.

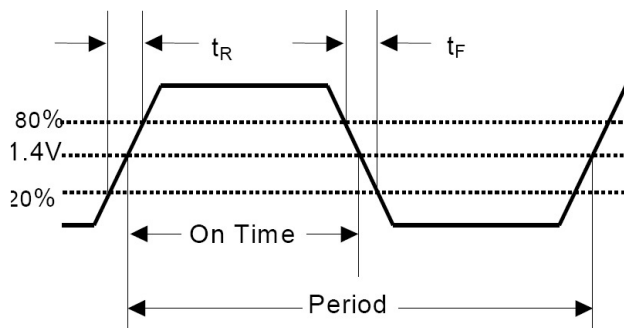


Figure 2. Output Waveform

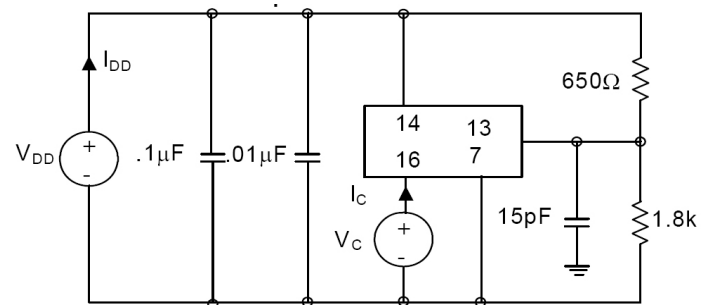


Figure 3. OUT1, OUT2, RCLK, RDATA Test Conditions (25  $\pm$  5°C)

## Absolute Maximum Ratings

Stresses in excess of the absolute maximum ratings can permanently damage the device. Functional operation is not implied at these or any other conditions in excess of conditions represented in the operational sections of this data sheet. Exposure to absolute maximum ratings for extended periods may adversely affect device reliability.

**Table 2. Absolute Maximum Ratings**

| Parameter                      | Symbol        | Ratings                         | Unit   |
|--------------------------------|---------------|---------------------------------|--------|
| Power Supply                   | VDD           | 7                               | Vdc    |
| Storage Temperature            | Tstorage      | -55/125                         | °C     |
| Soldering Temperature/Duration | TPEAK / tP    | 260 / 40                        | °C/sec |
| Clock and Data Input Range     | CLKIN, DATAIN | Gnd-0.5 to V <sub>DD</sub> +0.5 | V      |

## Reliability

The CD-700 is capable of meeting the following qualification tests:

**Table 3. Environmental Compliance**

| Parameter              | Conditions                            |
|------------------------|---------------------------------------|
| Mechanical Shock       | MIL-STD-883, Method 2002              |
| Mechanical Vibration   | MIL-STD-883, Method 2007              |
| Solderability          | MIL-STD-883, Method 2003              |
| Gross and Fine Leak    | MIL-STD-883, Method 1014, 100% Tested |
| Resistance to Solvents | MIL-STD-883, Method 2016              |

## Handling Precautions

Although ESD protection circuitry has been designed into the the CD-700, proper precautions should be taken when handling and mounting. VI employs a Human Body Model (HBM) and a Charged Device Model (CDM) for ESD susceptibility testing and design protection evaluation. ESD thresholds are dependent on the circuit parameters used to define the model.

**Table 4. Predicted ESD R\$atings**

| Model                | Minimum | Conditions               |
|----------------------|---------|--------------------------|
| Human Body Model     | 1500 V  | MIL-STD 883, Method 3015 |
| Charged Device Model | 1000 V  | JESD 22-C101             |

## Phase Detector

The phase detector has two buffered inputs (DATAIN and CLKIN) which are designed to switch at 1.4 volts. DATAIN is designed to accept an NRZ data stream but may also be used for clock signals which have a 50% duty cycle. CLKIN is connected to OUT1 or OUT2, or a divided version of one of these outputs. CLKIN and DATAIN are protected by ESD diodes and should not exceed the power supply voltage or ground by more than a few hundred millivolts.

The phase detector is basically a latched flip flop/exclusive-or gate/differential amplifier filter design to produce a DC signal proportional to the phase between the CLKIN and DATAIN signals (see Figure 4 for a block diagram and Figure 5 for an open loop transfer curve). This will simplify the PLL design as the designer does not have to filter narrow pulse signals to a DC level. Under locked conditions the rising edge of CLKIN will be centered in the middle of the DATAIN signal (see Figure 6).

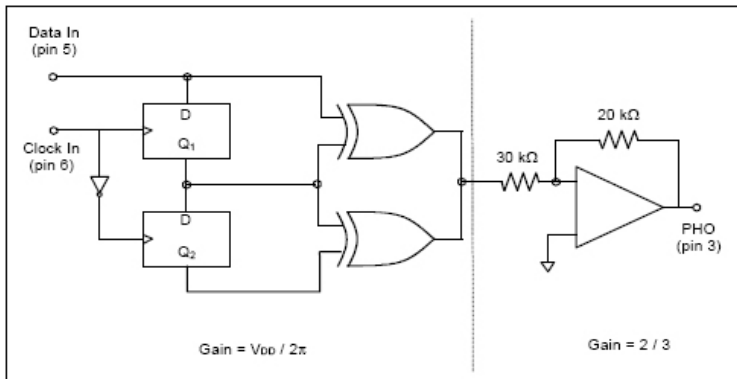


Figure 4. Simplified Phase Detector Block Diagram

The phase detector gain is 0.53V/rad x data density for 5volt operation and 0.35V/rad x data density for 3.3 volt operation. Data density is equal to 1.0 for clock signals and is system dependent on coding and design for NRZ signals, but 0.25 could be used as a starting point for data density.

The phase detector output is a DC signal for DATAIN frequencies greater than 1 MHz but produces significant ripple when inputs are less than 200 kHz. Additional filtering is required for lower input frequencies applications such as 8kHz (see Figures 8 and 9 as examples).

Under closed loop conditions the active filter has a blocking capacitor which provides a very high DC gain, so under

normal locked conditions and input frequencies >1 MHz, PHO will be about VDD/2 and will not vary significantly with changes in input frequency (within lock range). The control voltage (pin 16) will vary according to the input frequency offset, but PHO will remain relatively constant.

## Recovered Clock and Data Alignment Outputs

The CD-700 is designed to recover an embedded clock from an NRZ data signal and retime it with a data pattern. In this application, the VCXO frequency is exactly the same frequency as the NRZ data rate and the outputs are taken off Pin 9 (RCLK), and Pin 10 (RDATA). Under locked conditions, the falling edge of RCLK is centered in the RDATA pattern. Also, there is a 1.5 clock cycle delay between DATAIN and RDATA. Figure 6 shows the relationship between the DATAIN, CLKIN, RDATA and RCLK.

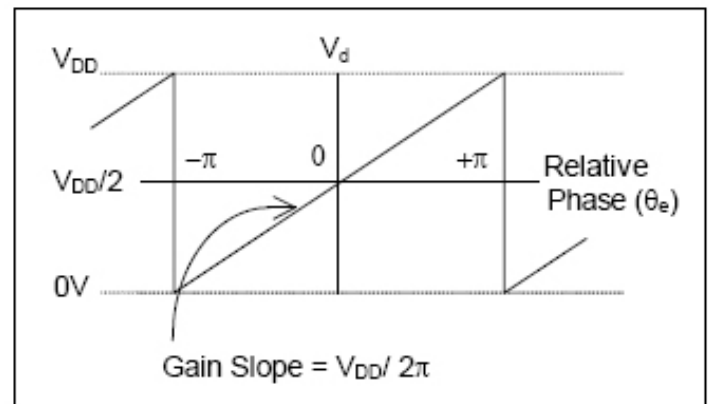


Figure 5. Open Loop Phase Detector Transfer Curve

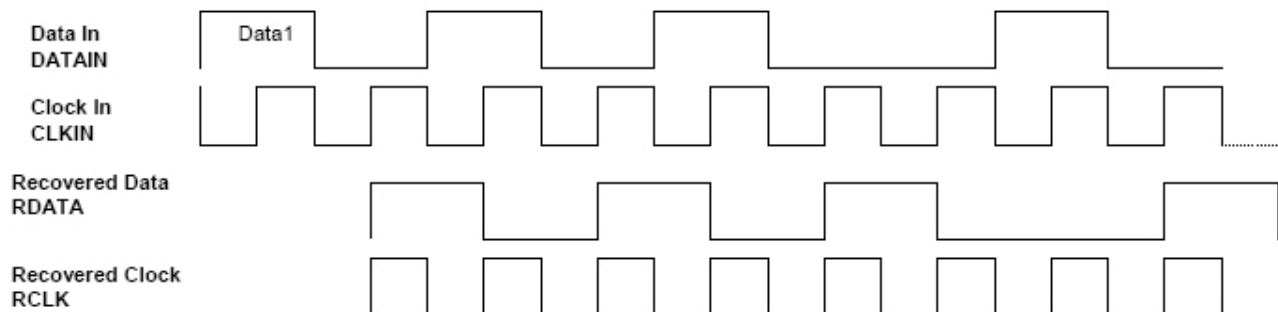


Figure 6. Clock and Data Timing Relationships for the NRZ data

Other RZ encoding schemes such as Manchester or AMI can be accommodated by using a CD-700 at twice the baud rate.

## Loss of Signal, LOS and LOSIN

The LOS circuit provides an output alarm flag when the DATAIN input signal is lost. The LOS output is normally a logic low and is set to a logic high after 256 consecutive clock periods on CLKIN with no detected DATAIN transitions. This signal can be used to either flag external alarm circuits and/or drive the CD-700's LOSIN input. When LOSIN is set to a logic high, the VCXO control voltage (pin 16) is switched to an internal voltage which sets OUT1 and OUT2 to center frequency  $\pm 75$  ppm. Also, LOS automatically closes the op amp feedback which means the op-amp is a unity gain buffer and will produce a DC voltage equal to the +op amp voltage (pin 15), usually  $V_{DD}/2$ .

## VCXO and Absolute Pull Range (APR) Specification

The CD-700's VCXO is a varactor tuned crystal oscillator, which produces an output frequency proportional to the control voltage (pin 16). The frequency deviation of the CD-700 VCXO is specified in terms of Absolute Pull Range (APR). APR provides the user with a guaranteed specification for minimum available frequency deviation over all operating conditions. Operating conditions include power supply variation, operating temperature range, and differences in output loading and changes due to aging.

A CD-700 VCXO with an APR of  $\pm 50$  ppm will track a  $\pm 50$  ppm reference source over all operating conditions. The fourth character of the product code in Table 7 specifies absolute Pull Range (APR). Please see Vectron's web site ([www.vectron.com](http://www.vectron.com)) for the APR Application Note. APR is tested at 0.5 and 4.5 volts for the 5.0 volt option and 0.3 and 3.0 volts for the 3.3 volt option.

## VCXO Aging

Quartz oscillators typically exhibit a part per million shift in output frequency during aging. The major factors, which lead to this shift, are changes in the mechanical stress on the crystal and mass-loading on the crystal.

As the oscillator ages, relaxation of the crystal mounting stress or transfer of environmental stress through the package to the crystal mounting arrangement can lead to frequency variations. VI has minimized these two effects through the use of a miniature AT-cut strip resonator crystal which allows a superior mounting arrangement. This results in minimal relaxation and almost negligible environmental stress transfer.

VI has eliminated the impact of mass loading by ensuring hermetic integrity and minimizing out-gassing by limiting the number of internal components through the use of ASIC technology. Mass-loading on the crystal generally results in a frequency decrease and is typically due to out-gassing of material within a hermetic package or from contamination by external material in a non-hermetic package. Under normal operating conditions the CD-700 will typically exhibit 2 ppm aging in the first year of operation. The device will then typically exhibit 1 ppm aging the following year with a logarithmic decline each year thereafter.

## Frequency Divider Feature

The lowest available VCXO OUT1 frequency is 1.000 MHz. To achieve lower frequencies, OUT1 is divided by a  $2^n$  counter ( $n = 1$  to 8) and is the OUT2 frequency. The divider values (2, 4, 8, 16, 32, 64, 128 and 256) are set at the factory, so it is user selectable upon ordering only. In addition, a disabled OUT2 option is also available. To achieve 1.024 MHz, a CD-700 with OUT1 frequency equal to 16.384 MHz and a divider value equal to 16 would be used. Additional external divider circuits can be used to further lower or change the frequency.

## Loop Filter

A PLL is a feedback system which forces the output frequency to lock in both phase and frequency to the input frequency. While there will be some phase error, theory states there is no frequency error. The loop filter design will dictate many key parameters such as jitter reduction, stability, lock range and acquisition time. Be advised that many textbook equations describing loop dynamics, such as capture range are based on ideal systems. Such equations may not be accurate for real systems due to nonlinearities, DC offsets, noise and do not take into account the limited VCXO bandwidth. This section deals with some real world design examples. Also, there is loop filter software on the Vectron web site, plus a full staff of experienced applications engineers who are eager to assist in this process. Common CD-700 PLL applications are shown in Figures 8, 9 (frequency translation), Figure 10 (clock recovery) and Figure 11 (clock smoothing).

Of primary concern to the designer is selecting a loop filter that insures lock-in, stability and provides adequate filtering of the input signal. For low input frequencies, a good starting point for the loop filter bandwidth is 10 Hz (typical). An example would be translating an 8 kHz signal to 44.736 MHz. Figures 8 and 9 show 8kHz to 44.736 MHz and 8kHz to 19.440 MHz frequency translation designs. For high input frequencies, a good starting point for the loop filter bandwidth is 100 ppm times the input frequency.

It's fairly easy to set a low loop bandwidth for large frequency translations such as 8kHz to 44.736MHz, but becomes more difficult for clock smoothing applications such as 19.440 MHz input and 19.440MHz output. In this example,  $100\text{ppm} \times 19.440\text{MHz}$  is approximately 2kHz and this loop filter bandwidth may be too high to adequately reject jitter. A good way to resolve this is to lower the DATAIN frequency such as dividing the input frequency down. The loop filter bandwidth becomes lower since  $100\text{ppm} \times \text{DATAIN}$  is lowered. Figure 11 shows an example for clock smoothing on a relatively high input frequency signal and maintaining a wide lock range.

There is no known accurate formula for calculating acquisition time and so the best way to provide realistic figures is to measure the lock time for a CD-700. By measuring the control voltage settling time, acquisition time was measured in the range of 3-5 seconds for applications such as 8kHz to 34.368 MHz frequency translation which is similar to the application in Figures 8 and 9, to sub 10 milliseconds for NRZ data patterns such as Figure 10. It may be tempting to reduce the damping factor to 0.7 or 1.0 in order to improve acquisition time; but, it degrades stability and will not significantly improve acquisition time. A damping factor of 4 is fairly conservative and allows for excellent stability.

Some general guidelines for selecting the loop filter elements include: Values should be less than 1Megohm and at least 10kohm between the PHO and OPN, the capacitor should be low leakage and a polarized capacitor is acceptable, the R/C's should be located physically close to the CD-700. The loop filter software available on the web site was written for 5 volt operation. A simple way to calculate values for 3.3 volt operation is to multiply the data density by 0.66 ( $3.3\text{V} / 5\text{V}$ ).

SPIICE models are another design aid. In most cases a new PLL CD-700 design is calculated by using the software and verified with SPIICE models. The simple active SPIICE model is shown in Figure 7.

Loop filter values can be modified to suit the system requirements and application. There are many excellent references on designing PLL's, such as "Phase-Locked Loops, Theory, Design and Applications", by Roland E Best (McGraw-Hill).

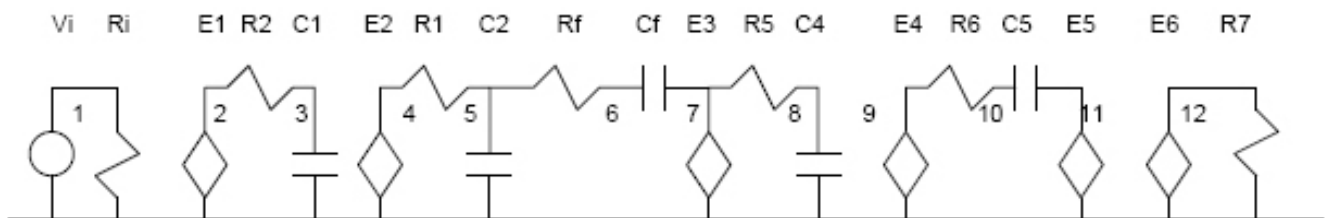


Figure 7. SPIICE Model

\*\*\*\*\*CD-700 ac Loop model

vi 1 0 ac 1

ri 1 0 1k

\*\*\*\*\*Phase Detector

e1 2 0 1 0 1 (for closed loop response use: e1 2 0 1 12 1)

r2 2 3 30k

c1 3 0 60p

\*\*\*\*\*Phase Detector Gain= $0.53 \times \text{Data Density}$  (Data Density = 1 for clocks) for 5 volt operation and =  $0.35 \times \text{Data Density}$  for 3.3 volt operation

e2 4 0 3 0 .35

\*\*\*\*\*Loop filter

r1 4 5 60k

c2 5 0 10p

rf 5 6 90k

cf 6 7 1.0u

e3 7 0 5 0 -10000

\*\*\*\*\* VCXO, Input Bandwidth=50kHz

r5 7 8 160k

c4 8 0 20p

\*\*\*\*\*VCXO Gain x 2Π (Example: 19.440 MHz x 100 ppm x 2 x Π)

e4 9 0 8 0 12214

\*\*\*\*\*1/S model

r6 9 10 1000

c5 10 11 0.001u

e5 11 0 10 0 -1e6

\*\*\*\*Divide by n

e6 12 0 11 0 1

r7 12 0 1k

The bold numbers are user selectable R and C values that will vary depending on the application (see Figure 11).

## Layout Considerations

To achieve stable, low noise performance good analog layout techniques should be incorporated and a partial list is shown below.

The CD-700 should be treated more like an analog device and the power supply must be well decoupled with a good quality RF 0.01 uF capacitor in parallel with a 0.1 uF capacitor, located as close to pin 14 as possible and connected to ground. In some cases, a PI filter such as a large capacitor (10uF) to ground, a series ferrite bead or inductor with 0.01 uF and 100 pF capacitor to ground to decouple the device supply.

The traces for the OUT1, OUT2, RCLK and RDATA outputs should be kept as short as possible. It is common practice to use a series resistor ( 50 to 100 ohms ) in order to reduce reflections if these traces are more than a couple of inches long. Also OUT1, OUT2, RCLK and RDATA should not be routed directly underneath the device.

The op-amp loop filter components should be kept as close to the device as possible and the feedback capacitor should be located close to the op-amp input terminal. The loop filter capacitor(s) should be low leakage (polarized capacitors are allowed).

Unused outputs should be left floating and it is not required to load or terminate them (such as an ECL or PECL output). Loading unused outputs will only increase current consumption.

## Application Circuits

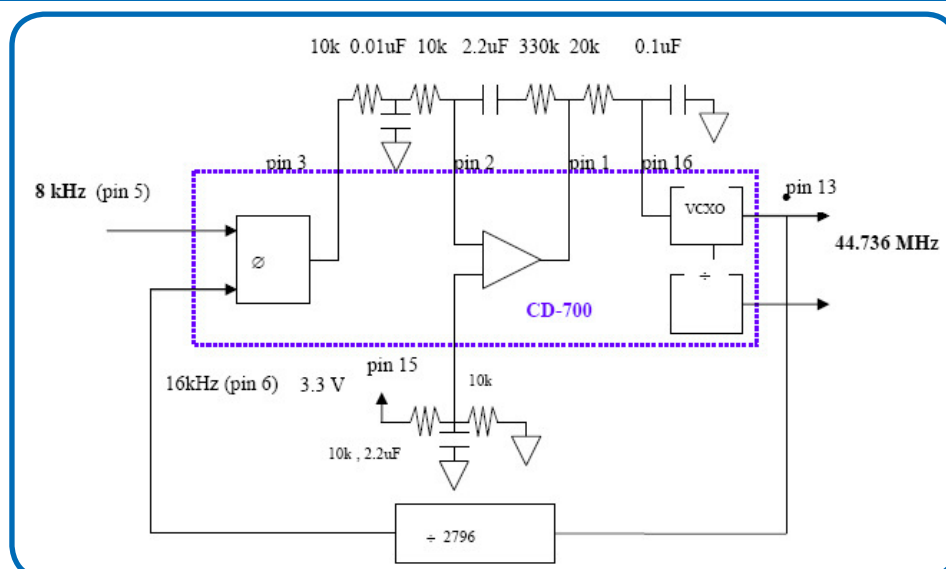


Figure 8. 8kHz to 44.736MHz Frequency Translation

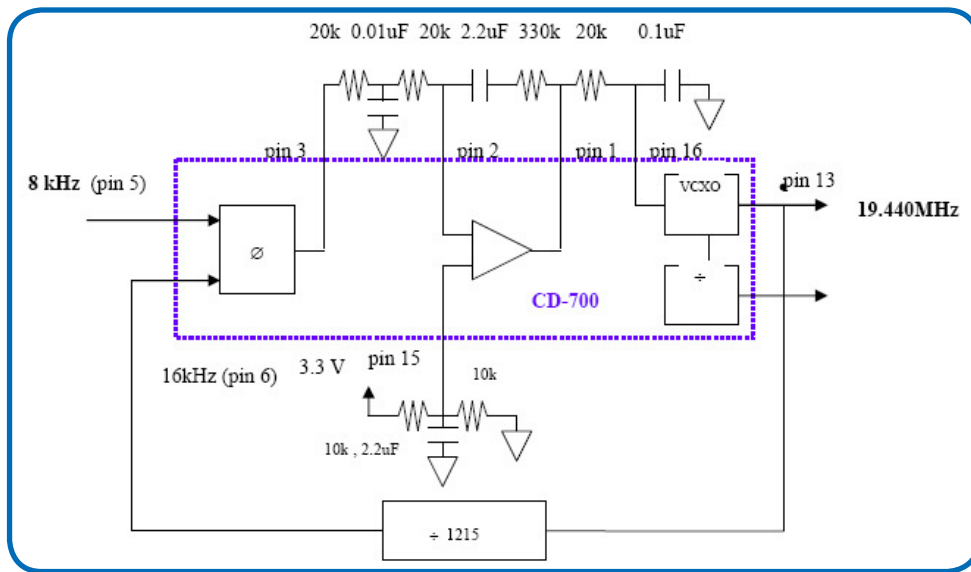


Figure 9. 8kHz to 19.44MHz Frequency Translation

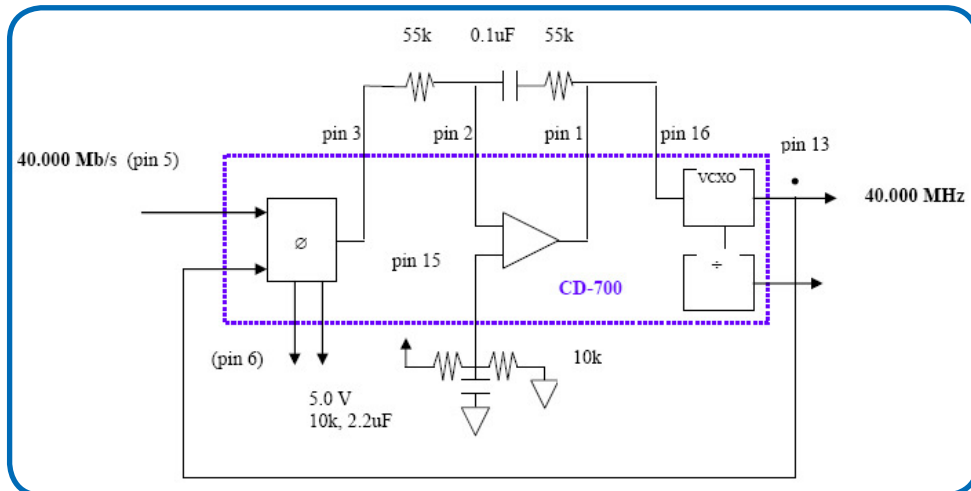


Figure 10. 40.00MHz NRZ Clock Recovery

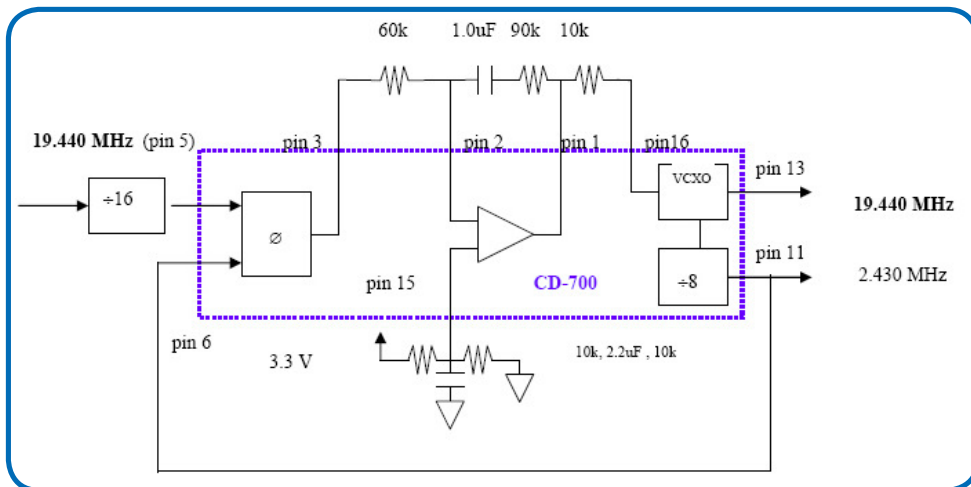
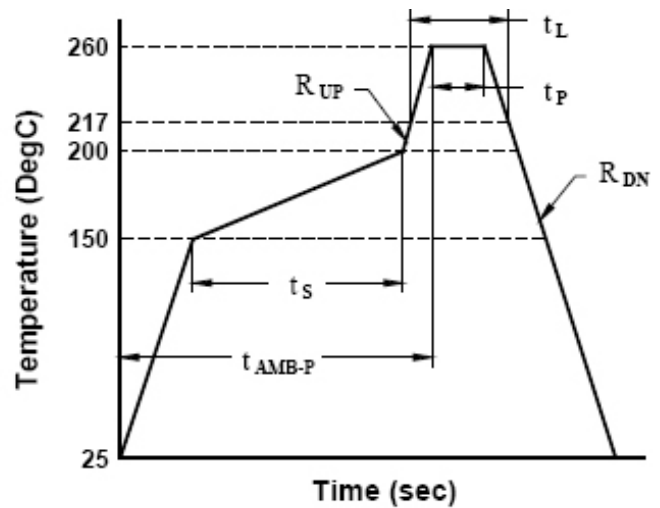


Figure 11. 19.44MHz Clock Smoothing

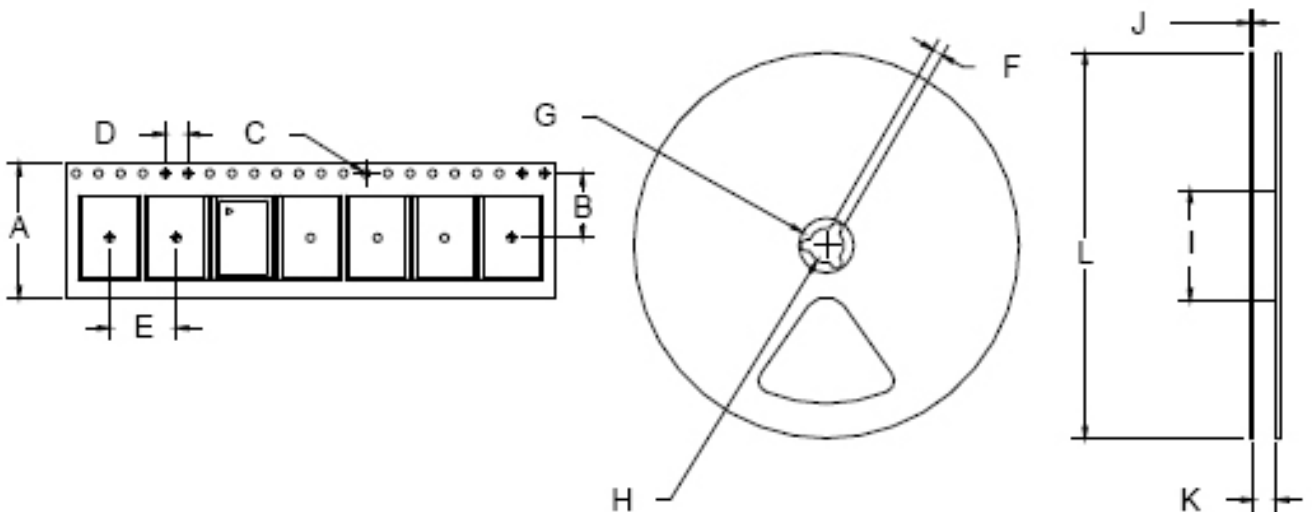
**Table 5. Environmental Compliance**

| Parameter                | Symbol      | Value                   |
|--------------------------|-------------|-------------------------|
| PreHeat Time             | $t_s$       | 60 sec Min, 180 sec Max |
| Ramp Up                  | $R_{UP}$    | 3 °C/sec Max            |
| Time Above 217 °C        | $t_L$       | 60 sec Min, 150 sec Max |
| Time To Peak Temperature | $t_{AMP-B}$ | 480 sec Max             |
| Time At 260 °C           | $t_P$       | 20 sec Min, 40 sec Max  |
| Ramp Down                | $R_{DN}$    | 6 °C/sec Max            |

The device has been qualified to meet the JEDEC standard for Pb-Free assembly. The temperatures and time intervals listed are based on the Pb-Free small body requirements. The temperatures refer to the topside of the package, measured on the package body surface. The CD-700 device is hermetically sealed so an aqueous wash is not an issue.

*Figure 12. Suggested IR Profile*

## Tape and Reel

*Figure 13. Tape and Reel***Table 6. Tape and Reel Information**

| Tape Dimensions (mm) |     |     |   |   | Reel Dimensions (mm) |      |    |    |   |      |     |        |
|----------------------|-----|-----|---|---|----------------------|------|----|----|---|------|-----|--------|
| A                    | B   | C   | D | E | F                    | G    | H  | I  | J | K    | L   | #/Reel |
| 16                   | 7.5 | 1.5 | 4 | 8 | 1.5                  | 20.2 | 13 | 50 | 6 | 16.4 | 178 | 200    |

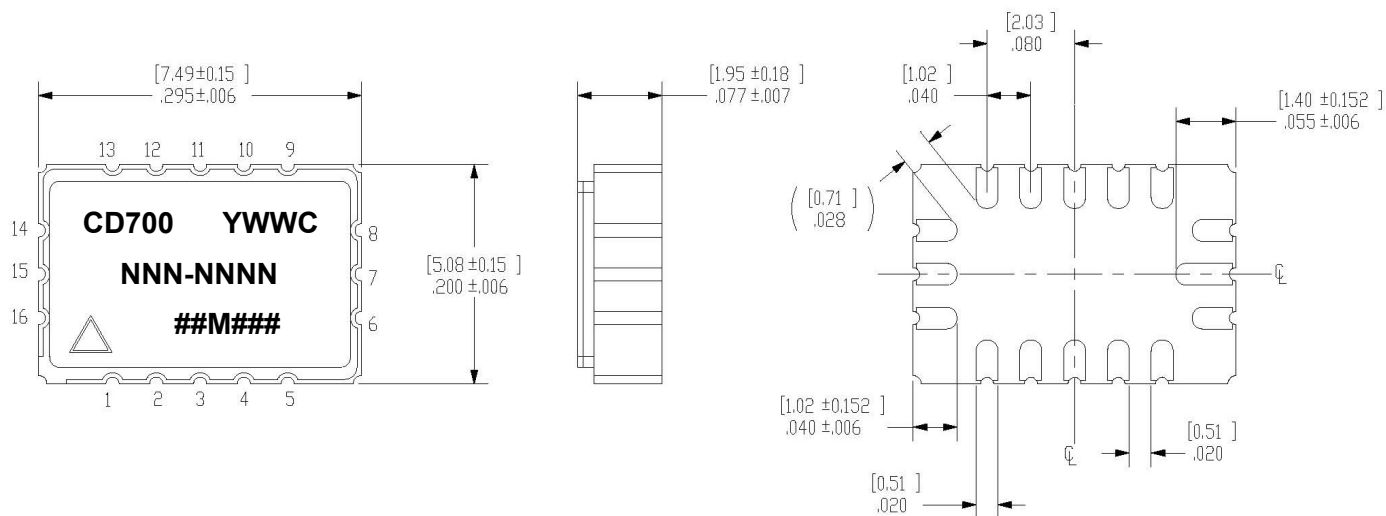


Figure 14. Outline Diagram

| Table 7. Pin Functions |                 |                                                                                                                                                                                                                                |
|------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pin                    | Symbol          | Function                                                                                                                                                                                                                       |
| 1                      | OPOUT           | Op-Amp Output                                                                                                                                                                                                                  |
| 2                      | OPN             | Op-Amp Negative Input                                                                                                                                                                                                          |
| 3                      | PHO             | Phase detector Output                                                                                                                                                                                                          |
| 4                      | LOSIN           | INPUT (Used with LOS)<br>Logic 0, VCXO control voltage is enabled.<br>Logic 1, VCXO control voltage (pin 16) is disabled and OUT1 and OUT2 are within +/-75 ppm of center frequency<br>Has Internal pull-down resistor         |
| 5                      | DATAIN          | Phase detector Input signal (TTL switching thresholds)                                                                                                                                                                         |
| 6                      | CLKIN           | Phase detector Clock signal (TTL switching thresholds)                                                                                                                                                                         |
| 7                      | GND             | Cover and Electrical Ground                                                                                                                                                                                                    |
| 8                      | LOS             | OUTPUT (Used with LOSIN)<br>Logic 1 if there are no transitions detected at DATAIN after 256 clock cycles at CLKIN. As soon as a transition occurs at DATAIN, LOS is set to a logic low.<br>Logic 0 = Input frequency detected |
| 9                      | RCLK            | Recovered Clock                                                                                                                                                                                                                |
| 10                     | RDATA           | Recovered Data                                                                                                                                                                                                                 |
| 11                     | OUT2            | Divided-down VCXO Output, or Disabled                                                                                                                                                                                          |
| 12                     | HIZ             | INPUT<br>Logic 0, OUT1, OUT2, RCLK, RDATA are set to a high impedance state.<br>Logic 1, OUT1, OUT2, RCLK, RDATA are active.<br>Has Internal pull-up resistor                                                                  |
| 13                     | OUT1            | VCXO Output                                                                                                                                                                                                                    |
| 14                     | V <sub>DD</sub> | Power Supply Voltage (3.3 V ±10% or 5.0 V ±10%)                                                                                                                                                                                |
| 15                     | OPP             | Op-Amp Positive Input                                                                                                                                                                                                          |
| 16                     | V <sub>C</sub>  | VCXO Control Voltage                                                                                                                                                                                                           |

**Table 8. Standard OUT1 Frequencies (MHz)**

|            |            |            |            |            |            |            |            |
|------------|------------|------------|------------|------------|------------|------------|------------|
| 12M2880000 | 19M2000000 | 21M0050840 | 29M4912000 | 38M8800000 | 44M4343000 | 52M0000000 | 70M0000000 |
| 12M3076860 | 19M3926580 | 22M0000000 | 29M5000000 | 39M0625000 | 44M6218000 | 53M3300000 | 70M6560000 |
| 12M3520000 | 19M4400000 | 22M1047720 | 30M0000000 | 39M3216000 | 44M7360000 | 54M7460000 | 71M6100000 |
| 12M8000000 | 19M5312500 | 22M2171000 | 30M7200000 | 39M8437500 | 44M9280000 | 55M0000000 | 73M7280000 |
| 13M0000000 | 19M6608000 | 22M5792000 | 30M8800000 | 40M0000000 | 45M1584000 | 60M0000000 | 74M1250000 |
| 13M5000000 | 19M6989680 | 24M0000000 | 31M2500000 | 40M2830630 | 45M8240000 | 61M3800000 | 74M1758000 |
| 14M8351600 | 19M7190000 | 24M5760000 | 32M0000000 | 40M9600000 | 46M0379460 | 61M4400000 | 74M2500000 |
| 15M0000000 | 19M9218750 | 24M7040000 | 32M7680000 | 41M0888870 | 46M7200000 | 62M2080000 | 75M0000000 |
| 15M0336000 | 20M0000000 | 25M0000000 | 33M0000000 | 41M6571440 | 46M8750000 | 62M5000000 | 76M8000000 |
| 15M3600000 | 20M1416000 | 25M1658000 | 33M3330000 | 41M6600000 | 48M0000000 | 62M9145000 | 77M7600000 |
| 16M0000000 | 20M4800000 | 25M6000000 | 34M3680000 | 41M8329130 | 49M1520000 | 63M3600000 |            |
| 16M3840000 | 20M5444340 | 25M9200000 | 34M5600000 | 42M0000000 | 49M4080000 | 63M8976000 |            |
| 17M1840000 | 20M7135000 | 26M0000000 | 36M8640000 | 42M0101690 | 50M0000000 | 64M0000000 |            |
| 18M4320000 | 20M8285720 | 27M0000000 | 37M0560000 | 42M5000000 | 50M0480000 | 64M1520000 |            |
| 18M5280000 | 20M8286000 | 27M6480000 | 37M1250000 | 42M6600000 | 51M2000000 | 65M5360000 |            |

## CD - 700 - D A E - K A N N - xxMxxxxxxx

### Product Family

CD: Clock and Data Recovery

### Package

700: 5.0 x 7.5 x 2.0mm

### Input

D: 5.0 Vdc  $\pm 10\%$

E: 3.3 Vdc  $\pm 10\%$

### Output

A: CMOS/HCMOS/ACMOS

### Operating Temperature

E: -40 to 85 °C

T: 0 to 70 °C

### Absolute Pull Range

K:  $\pm 50$  ppm

S:  $\pm 100$  ppm

### Frequency (See Above)

### Performance Options

N: Standard

A: Improved Phase Noise

### Factory Use

### Output 2 Divider

A: Divide by 2

B: Divide by 4

C: Divide by 8

D: Divide by 16

E: Divide by 32

F: Divide by 64

G: Divide by 128

H: Divide by 256

K: Disabled

Note: Not all combinations are available. Check with the factory for the optimum device configuration for your application



Microsemi, a wholly owned subsidiary of Microchip Technology Inc. (Nasdaq: MCHP), offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Learn more at [www.microsemi.com](http://www.microsemi.com).

### Microsemi Headquarters

One Enterprise, Aliso Viejo, CA 92656 USA

Within the USA: +1 (800) 713-4113

Outside the USA: +1 (949) 380-6100

Sales: +1 (949) 380-6136

Fax: +1 (949) 215-4996

email: [sales.support@microsemi.com](mailto:sales.support@microsemi.com)

[www.microsemi.com](http://www.microsemi.com)

Microsemi makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does Microsemi assume any liability whatsoever arising out of the application or use of any product or circuit. The products sold hereunder and any other products sold by Microsemi have been subject to limited testing and should not be used in conjunction with mission-critical equipment or applications. Any performance specifications are believed to be reliable but are not verified, and Buyer must conduct and complete all performance and other testing of the products, alone and together with, or installed in, any end-products. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the Buyer's responsibility to independently determine suitability of any products and to test and verify the same. The information provided by Microsemi hereunder is provided "as is, where is" and with all faults, and the entire risk associated with such information is entirely with the Buyer. Microsemi does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other IP rights, whether with regard to such information itself or anything described by such information. Information provided in this document is proprietary to Microsemi, and Microsemi reserves the right to make any changes to the information in this document or to any products and services at any time without notice.

©2018 Microsemi, a wholly owned subsidiary of Microchip Technology Inc. All rights reserved. Microsemi and the Microsemi logo are registered trademarks of Microsemi Corporation. All other trademarks and service marks are the property of their respective owners.