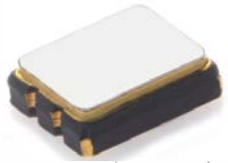
# Model 334C

## Advanced PLL HCMOS VCXO



Part Dimensions:
3.2 × 2.5 × 1.1mm • 24mg

### Features

- Ceramic Surface Mount Package
- Low Phase Jitter Performance, 600fs Typical
- Advanced PLL Design w/ Low Fundamental Crystal
- Frequency Range 10 – 250MHz *
- +2.5V or +3.3V Operation
- Output Enable Standard
- Tape and Reel Packaging, EIA-418

### Applications

- Broadcast Video Systems
- Storage Area Networking
- Broadband Access
- Phase-Locked Loop
- Networking Equipment
- Ethernet/GbE/SyncE
- Fiber Channel
- Test and Measurement

Standard Frequencies

| | | |
|---|---|---|
| - 50.00MHz | - 122.88MHz | - 156.25MHz |
| - 77.76MHz | - 125.00MHz | - 200.00MHz |
| - 100.00MHz | - 155.52MHz | |

* See Page 7 for additional developed frequencies.
Check with factory for availability of frequencies not listed.

### Description

CTS Model 334C is a low cost, high performance PLL voltage controlled oscillator supporting HCMOS output. Employing the latest IC technology, M334C has excellent stability and low phase jitter performance.

### Ordering Information

| Model | Output Type | Frequency Code [MHz] | Absolute Pull Range | Frequency Stability | Temperature Range | Supply Voltage | Packaging |
|---|---|---|---|---|---|---|---|
| 334 | C | XXX or XXXX | B | 3 | I | 3 | T |

| Code | Output |
|---|---|
| C | HCMOS |

| Code | APR |
|---|---|
| B | ±50ppm |

| Code | Temp. Range |
|---|---|
| C | -20°C to +70°C |
| I | -40°C to +85°C |

| Code | Packing |
|---|---|
| T | 1k pcs./reel |

| Code | Frequency |
|---|---|
| Product Frequency Code [1] | |

| Code | Stability |
|---|---|
| 5 | ±25ppm [2] |
| 4 | ±30ppm |
| 3 | ±50ppm |

| Code | Voltage |
|---|---|
| 2 | +2.5Vdc |
| 3 | +3.3Vdc |

Notes:

1] Refer to document 016-1454-0, Frequency Code Tables.
3-digits for frequencies <100MHz, 4-digits for frequencies 100MHz or greater.

2] Check factory availability when paired with "I" temperature code.

**Not all performance combinations and frequencies may be available.**
**Contact your local CTS Representative or CTS Customer Service for availability.**

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# Electrical Specifications

## Operating Conditions

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Maximum Supply Voltage | $V_{CC}$ | - | -0.5 | - | 4.0 | V |
| Maximum Control Voltage | $V_C$ | $V_{CC}$ = +2.5V | -0.5 | - | 3.0 | V |
| | | $V_{CC}$ = +3.3V | -0.5 | - | 3.8 | |
| Supply Voltage | $V_{CC}$ | ±5% | 2.375 | 2.5 | 2.625 | V |
| | | | 3.135 | 3.3 | 3.465 | |
| Supply Current | $I_{CC}$ | Maximum Load | - | 20 | 65 | mA |
| Operating Temperature | $T_A$ | - | -20 | +25 | +70 | °C |
| | | | -40 | | +85 | |
| Storage Temperature | $T_{STG}$ | - | -55 | - | +125 | °C |

## Frequency Stability

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Frequency Range | $f_O$ | - | | 10 - 250 | | MHz |
| Frequency Stability [Note 1] | $\Delta f/f_O$ | - | | 25, 30 or 50 | | ±ppm |
| Absolute Pull Range [Note 2] | APR | - | 50 | - | - | ±ppm |
| Aging | $\Delta f/f_{25}$ | First Year @ +25°C, nominal $V_{CC}$ | -3 | - | 3 | ppm |

1.] Inclusive of initial tolerance at time of shipment, changes in supply voltage, load, temperature and 1st year aging.

2.] Minimum guaranteed frequency shift from $f_O$ over variations in temperature, aging, power supply and load.

## Output Parameters

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Type | - | - | | HCMOS | | - |
| Output Load | $C_L$ | - | - | - | 15 | pF |
| Output Voltage Levels | $V_{OH}$ | CMOS Load | $0.9V_{CC}$ | - | - | V |
| | $V_{OL}$ | | - | - | $0.1V_{CC}$ | |
| Output Duty Cycle | SYM | @ 50% Level | 45 | - | 55 | % |
| Rise and Fall Time | $T_R$, $T_F$ | @ 20%/80% Levels, $C_L$ = 15pF | - | 5 | 10 | ns |
| Start Up Time | $T_S$ | Application of $V_{CC}$ | - | 3 | 5 | ms |
| Enable Function [Tri-State] | | | | | | |
| Enable Input Voltage | $V_{IH}$ | Pin 2 Logic '1', Output Enabled | $0.7V_{CC}$ | - | - | V |
| Disable Input Voltage | $V_{IL}$ | Pin 2 Logic '0', Output Disabled | - | - | $0.3V_{CC}$ | V |
| Disable Current | $I_{IL}$ | Pin 2 Logic '0', Output Disabled | - | 16 | 22 | mA |
| Enable Time | $T_{PLZ}$ | Pin 2 Logic '1', Output Enabled | - | - | 200 | ns |
| Phase Jitter, RMS | tjrms | Bandwidth 12 kHz - 20 MHz | - | 600 | <1000 | fs |
| Period Jitter, RMS | pjrms | - | - | 3.0 | - | ps |
| Period Jitter, pk-pk | pjpk-pk | - | - | 30 | - | ps |



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# Electrical Specifications

## Control Voltage

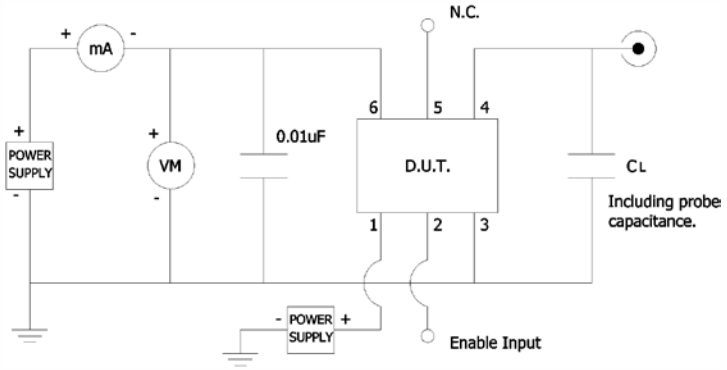
| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Control Voltage | $V_C$ | $V_{CC}$ = 2.5V | 0.2 | 1.25 | 2.3 | V |
| | | $V_{CC}$ = 3.3V | 0.3 | 1.65 | 3.0 | |
| Frequency Deviation | $\Delta f/f_O$ | $V_C$ = 0.2V | | -60 to -180 | | ppm |
| | | $V_C$ = 2.3V | | 60 to 180 | | |
| | | $V_C$ = 0.3V | | -60 to -180 | | ppm |
| | | $V_C$ = 3.0V | | 60 to 180 | | |
| Linearity | L | Best Straight Line Fit | - | - | ±15 | % |
| Gain Transfer | $K_V$ | Pull Sensitivity; @ +1.25V, +25°C | - | 80 | 260 | ppm/V |
| | | Pull Sensitivity; @ +1.65V, +25°C | | | | |
| Input Impedance | $Z_{Vc}$ | - | 1 | - | - | MOhms |
| Modulation Roll-off | - | @ -3dB | 10 | - | - | kHz |
| Transfer Function | - | - | | Positive | | - |

## Enable Truth Table

| Pin 2 | Pin 4 |
|---|---|
| Logic '1' | Output |
| Open | Output |
| Logic '0' | High Imp. |

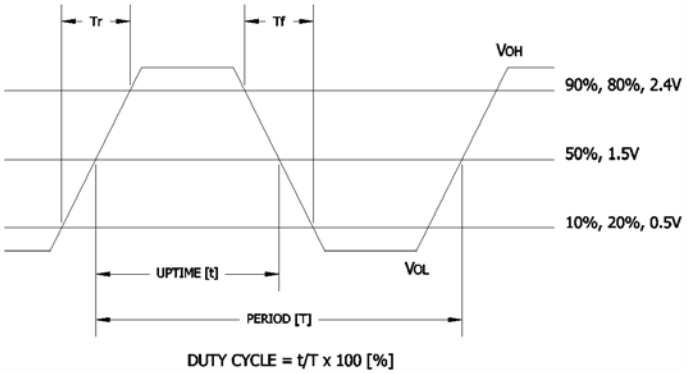
## Test Circuit

HCMOS




## Output Waveform

HCMOS



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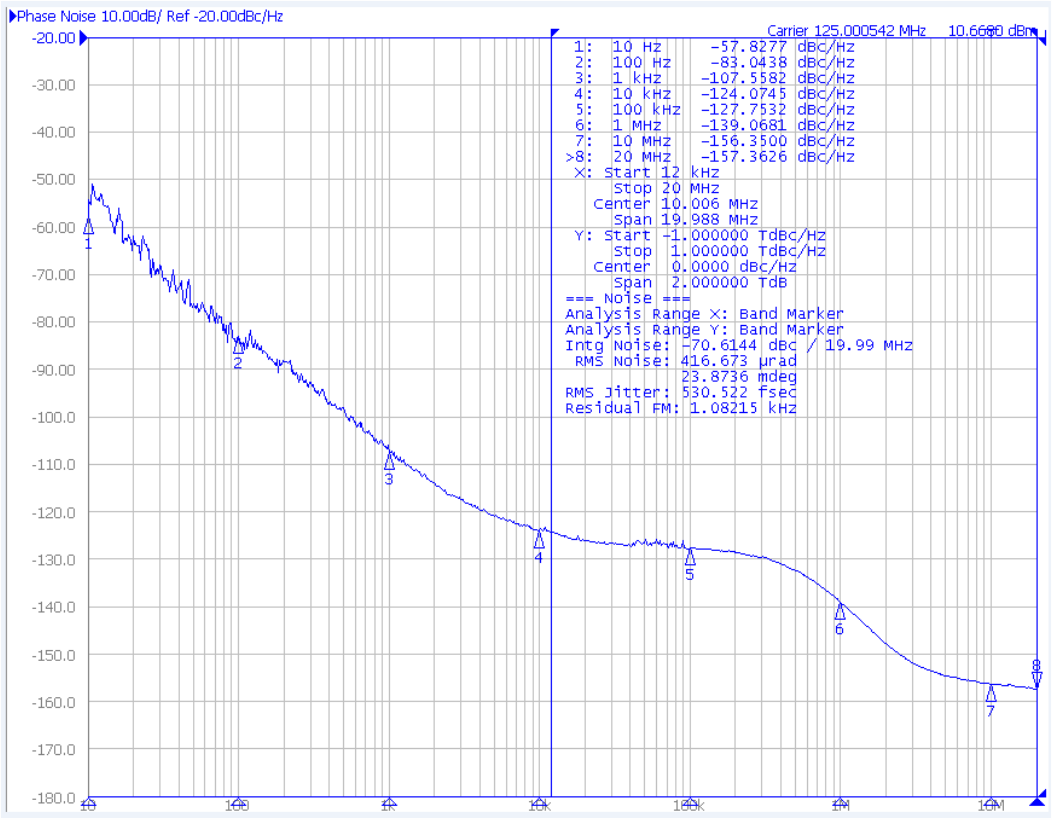
# Electrical Specifications

## Performance Data

### Phase Noise [typical]

125MHz, HCMOS, $V_{CC}$ = +3.3V, $V_C$ = +1.65V, $T_A$ = +25°C




### Phase Noise Tabulated

125MHz, HCMOS, $V_{CC}$ = +3.3V, $V_C$ = +1.65V, $T_A$ = +25°C

| PARAMETER | SYMBOL | CONDITIONS | TYP | UNIT |
|---|---|---|---|---|
| **HCMOS @ 125.00MHz** | | | | |
| **Phase Noise** | | Single Side Band | | |
| | | @ 10Hz | -57.8277 | |
| | | @ 100Hz | -83.0438 | |
| | | @ 1kHz | -107.5582 | |
| | - | @ 10kHz | -124.0745 | dBc/Hz |
| | | @ 100kHz | -127.7532 | |
| | | @ 1MHz | -139.0681 | |
| | | @ 10MHz | -156.3500 | |
| | | @ 20MHz | -157.3626 | |
| **Phase Jitter, RMS** | tjrms | Integration Bandwidth 12kHz - 20MHz | 530.5330 | fs |



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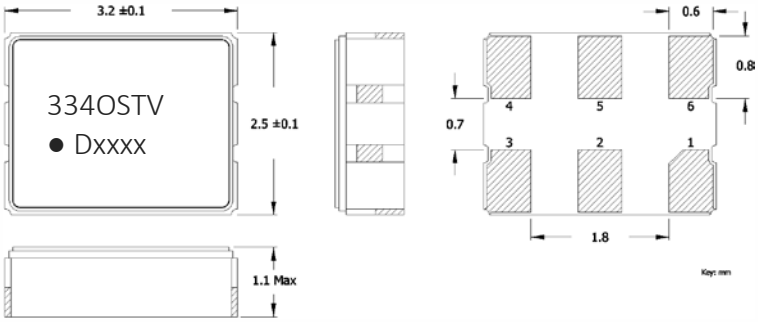
# Mechanical Specifications

## Package Drawing

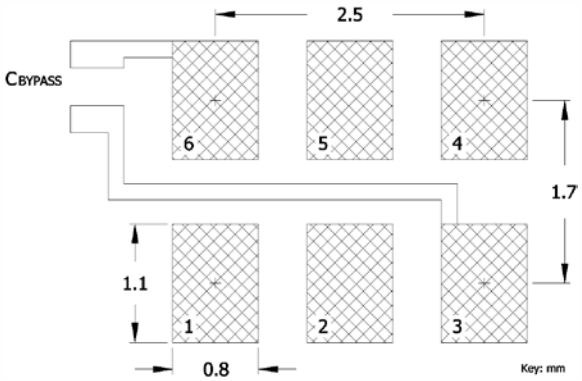



## Marking Information

1. O – Output Type; C = HCMOS.
2. ST – Frequency Stability/Temperature Code. [Refer to Ordering Information]
3. V – Voltage Code; 3 = 3.3V, 2 = 2.5V.
4. D – Date Code. See Table I for codes.
5. xxxx – Frequency Code.
   3-digits, frequencies below 100MHz
   4-digits, frequencies 100MHz or greater

[See document 016-1454-0, Frequency Code Tables.]

## Recommended Pad Layout




## Notes

1. JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
2. Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
3. MSL = 1.

## Pin Assignments

| Pin | Symbol | Function |
|---|---|---|
| 1 | $V_C$ | Voltage Control |
| 2 | EOH | Enable [tri-state] |
| 3 | GND | Circuit & Package Ground |
| 4 | Output | RF Output |
| 5 | N.C. | No Connect |
| 6 | $V_{CC}$ | Supply Voltage |

## Table I - Date Code

| YEAR \ MONTH | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2001 2005 2009 2013 2017 | A | B | C | D | E | F | G | H | J | K | L | M |
| 2002 2006 2010 2014 2018 | N | P | Q | R | S | T | U | V | W | X | Y | Z |
| 2003 2007 2011 2015 2019 | a | b | c | d | e | f | g | h | j | k | l | m |
| 2004 2008 2012 2016 2020 | n | p | q | r | s | t | u | v | w | x | y | z |



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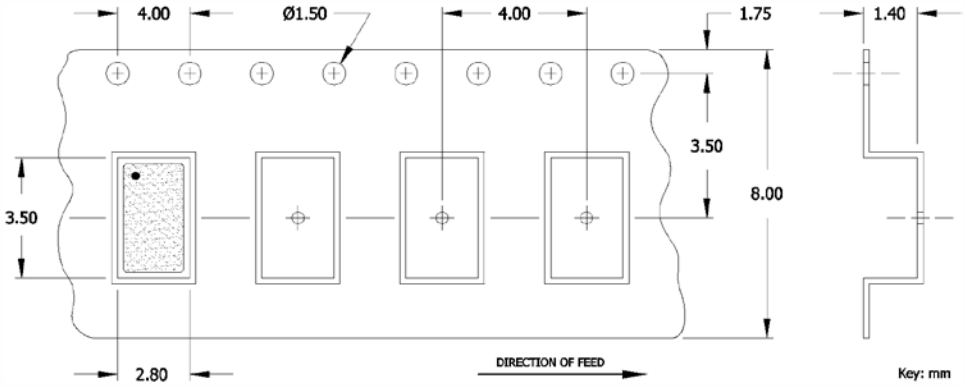
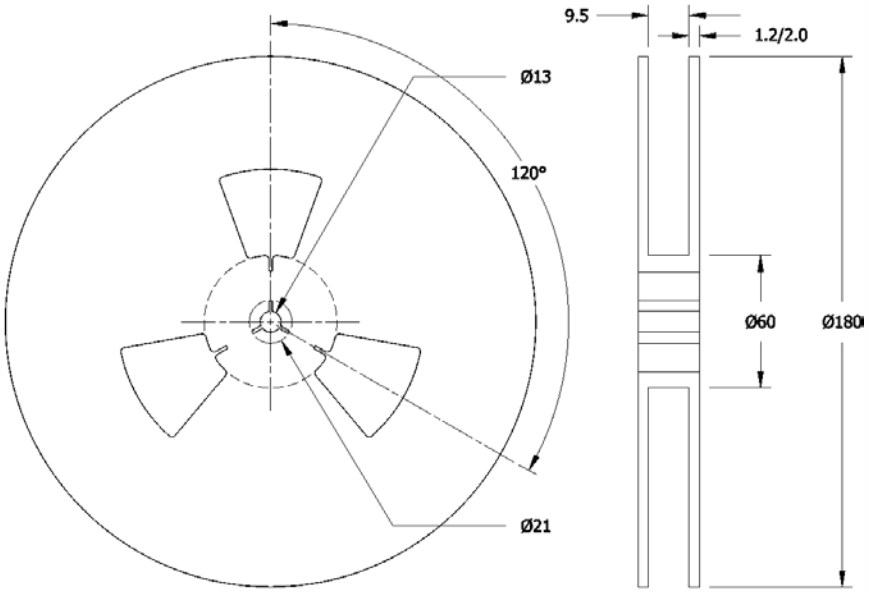
# Packaging - Tape and Reel

## Tape Drawing




## Reel Drawing




## Notes

1. Device quantity is 1k pieces minimum and 3k pieces maximum per 180mm reel.
2. Complete CTS part number, frequency value and date code information must appear on reel and carton labels.



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# Addendum

## Additional Developed Frequencies – MHz

| FREQUENCY | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE |
|---|---|---|---|---|---|---|---|
| 25.000000 | 250 | 150.000000 | 1500 | | | | |
| 62.500000 | 625 | 153.600000 | 1536 | | | | |
| 106.250000 | 1062 | 250.000000 | 2500 | | | | |
| 132.000000 | 1320 | | | | | | |
| 148.500000 | 1485 | | | | | | |

## Frequency Codes for Cover Page Table – MHz

| FREQUENCY | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE |
|---|---|---|---|
| 50.000000 | 500 | 155.520000 | 1555 |
| 77.760000 | 777 | 156.250000 | 1562 |
| 100.000000 | 1000 | 200.000000 | 2000 |
| 122.880000 | 1228 | | |
| 125.000000 | 1250 | | |



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