

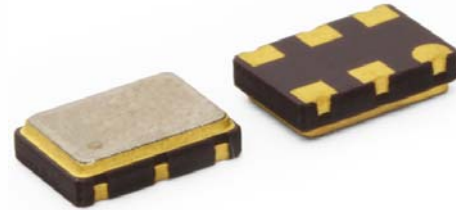


# Model 317

## HFF HCMOS VCXO

### Features

- Ceramic Surface Mount Package
- Ultra-Low Phase Jitter Performance
- High Frequency Fundamental Crystal Design
- Frequency Range 100 – 170MHz \*
- +3.3V Operation
- Output Enable Standard
- Tape and Reel Packaging, EIA-418



Part Dimensions:  
7.0 × 5.0 × 2.0mm • 178.462mg

### Applications

- Small Cells
- Wireless Communication
- Broadband Access
- SONET/SDH/DWDM
- Base Stations
- Ethernet/GbE/SyncE
- Digital Video
- Test and Measurement

#### Standard Frequencies

- 100.00MHz
- 122.88MHz
- 125.00MHz
- 153.60MHz
- 155.52MHz
- 156.25MHz
- 166.00MHz

\* Check with factory for availability.

### Description

CTS Model 317 is a low cost, small size, high performance VCXO. Employing the latest IC technology, coupled with a high frequency fundamental crystal, M317 has excellent stability and low jitter/phase noise performance.

### Ordering Information

| Model                               | Supply Voltage                                                                             | Absolute Pull Range                                                                 | Frequency Stability | Temperature Range | Frequency Code [MHz] | Packaging |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
|-------------------------------------|--------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---------------------|-------------------|----------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------------|--------|----------------|--------|----------------|---------------------|-----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|---------|-----------|-------------------------------------|--|--|
| 317                                 | L                                                                                          | B                                                                                   | 3                   | I                 | XXX or XXXX          | T         |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
|                                     | <table><tr><th>Code</th><th>Voltage</th></tr><tr><td>L</td><td>+3.3V ±5%</td></tr></table> | Code                                                                                | Voltage             | L                 | +3.3V ±5%            |           | <table><tr><th>Code</th><th>Stability</th></tr><tr><td>3</td><td>±50ppm</td></tr><tr><td>5</td><td>±25ppm</td></tr><tr><td>6</td><td>±20ppm<sup>1</sup></td></tr></table> | Code                                                                                                                                          | Stability | 3           | ±50ppm | 5              | ±25ppm | 6              | ±20ppm <sup>1</sup> |                                                                                               | <table><tr><th>Code</th><th>Frequency</th></tr><tr><td colspan="2">Product Frequency Code<sup>2</sup></td></tr></table> | Code    | Frequency | Product Frequency Code <sup>2</sup> |  |  |
| Code                                | Voltage                                                                                    |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
| L                                   | +3.3V ±5%                                                                                  |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
| Code                                | Stability                                                                                  |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
| 3                                   | ±50ppm                                                                                     |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
| 5                                   | ±25ppm                                                                                     |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
| 6                                   | ±20ppm <sup>1</sup>                                                                        |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
| Code                                | Frequency                                                                                  |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
| Product Frequency Code <sup>2</sup> |                                                                                            |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |
|                                     |                                                                                            | <table><tr><th>Code</th><th>APR</th></tr><tr><td>B</td><td>±50ppm</td></tr></table> | Code                | APR               | B                    | ±50ppm    |                                                                                                                                                                           | <table><tr><th>Code</th><th>Temp. Range</th></tr><tr><td>C</td><td>-20°C to +70°C</td></tr><tr><td>I</td><td>-40°C to +85°C</td></tr></table> | Code      | Temp. Range | C      | -20°C to +70°C | I      | -40°C to +85°C |                     | <table><tr><th>Code</th><th>Packing</th></tr><tr><td>T</td><td>1k pcs./reel</td></tr></table> | Code                                                                                                                    | Packing | T         | 1k pcs./reel                        |  |  |
| 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                                                                               |                                                                                     |                     |                   |                      |           |                                                                                                                                                                           |                                                                                                                                               |           |             |        |                |        |                |                     |                                                                                               |                                                                                                                         |         |           |                                     |  |  |

#### Notes:

- 1] Only available with "C" temperature range.
- 2] Refer to document 016-1454-0, Frequency Code Tables.  
3-digits for frequencies <100MHz, 4-digits for frequencies 100MHz or greater.

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

## Electrical Specifications

### Operating Conditions

| PARAMETER               | SYMBOL    | CONDITIONS                                         | MIN        | TYP | MAX        | UNIT             |
|-------------------------|-----------|----------------------------------------------------|------------|-----|------------|------------------|
| Maximum Supply Voltage  | $V_{CC}$  | -                                                  | -0.5       | -   | 5.0        | V                |
| Maximum Control Voltage | $V_C$     | -                                                  | -0.5       | -   | $V_{CC}$   | V                |
| Supply Voltage          | $V_{CC}$  | $\pm 5\%$                                          | 3.14       | 3.3 | 3.47       | V                |
| Supply Current          | $I_{CC}$  | Typical @ $C_L = 15$ pF, $T_A = +25^\circ\text{C}$ | -          | 20  | 30         | mA               |
| Output Load             | $C_L$     | -                                                  | -          | -   | 15         | pF               |
| Operating Temperature   | $T_A$     | -                                                  | -20<br>-40 | +25 | +70<br>+85 | $^\circ\text{C}$ |
| Storage Temperature     | $T_{STG}$ | -                                                  | -40        | -   | +100       | $^\circ\text{C}$ |

### Frequency Stability

| PARAMETER                       | SYMBOL            | CONDITIONS                                                              | MIN | TYP          | MAX | UNIT      |
|---------------------------------|-------------------|-------------------------------------------------------------------------|-----|--------------|-----|-----------|
| Frequency Range                 | $f_0$             | -                                                                       |     | 100 - 170    |     | MHz       |
| Frequency Stability<br>[Note 1] | $\Delta f/f_0$    | $\pm 20$ ppm stability, $-20^\circ\text{C}$ to $+70^\circ\text{C}$ only |     | 20, 25 or 50 |     | $\pm$ ppm |
| Absolute Pull Range<br>[Note 2] | APR               | -                                                                       | 50  | -            | -   | $\pm$ ppm |
| Aging                           | $\Delta f/f_{25}$ | First Year @ $+25^\circ\text{C}$ , nominal $V_{CC}$ and $V_C$           | -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  $f_0$  over variations in temperature, aging, power supply and load.

### Output Parameters

| PARAMETER             | SYMBOL               | CONDITIONS                                               | MIN              | TYP    | MAX              | UNIT          |
|-----------------------|----------------------|----------------------------------------------------------|------------------|--------|------------------|---------------|
| Output Type           | -                    | -                                                        |                  | HCMOS  |                  | -             |
| Output Voltage Levels | $V_{OH}$<br>$V_{OL}$ | Logic '1' Level, CMOS Load<br>Logic '0' Level, CMOS Load | $0.9V_{CC}$<br>- | -<br>- | -<br>$0.1V_{CC}$ | V             |
| Output Duty Cycle     | SYM                  | @ 50% Level                                              | 45               | -      | 55               | %             |
| Rise and Fall Time    | $T_R, T_F$           | @ 20%/80% Levels                                         | -                | 1.5    | 3.0              | ns            |
| Start Up Time         | $T_S$                | Application of $V_{CC}$                                  | -                | -      | 5                | ms            |
| Enable Function       |                      |                                                          |                  |        |                  |               |
| 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 Standby                          | -                | -      | $0.3V_{CC}$      | V             |
| Standby Current       | $I_{STB}$            | Pin 2 Logic '0', Output Standby                          | -                | -      | 10               | $\mu\text{A}$ |
| Enable Time           | $T_{PLZ}$            | Pin 2 Logic '1'                                          | -                | -      | 2                | ms            |
| Phase Jitter, RMS     | $t_{jrms}$           | Bandwidth 12 kHz - 20 MHz                                | -                | 50     | 500              | fs            |
| Phase Noise           | -                    | See Typical Plots                                        | -                | -      | -                | -             |

### Enable Truth Table

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

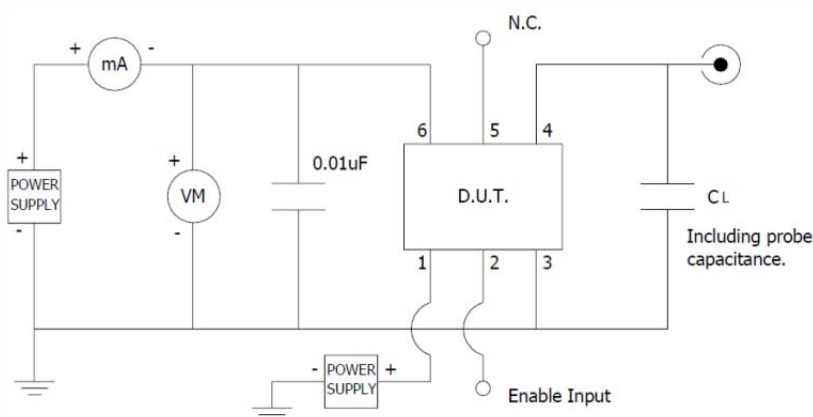
## Electrical Specifications

### Control Voltage

| PARAMETER           | SYMBOL         | CONDITIONS                        | MIN  | TYP         | MAX  | UNIT  |
|---------------------|----------------|-----------------------------------|------|-------------|------|-------|
| Control Voltage     | $V_C$          | -                                 | 0.30 | 1.65        | 3.00 | V     |
| Frequency Deviation | $\Delta f/f_0$ | $V_C = 0.0V$                      |      | -155 to -75 |      | ppm   |
|                     |                | $V_C = 3.3V$                      |      | 75 to 155   |      |       |
| Linearity           | L              | Best Straight Line Fit            | -    | 5           | 10   | %     |
| Gain Transfer       | $K_V$          | Pull Sensitivity; @ +1.65V, +25°C | -    | 65          | -    | ppm/V |
| Input Impedance     | $Z_{Vc}$       | -                                 | 100  | -           | -    | kOhms |
| Modulation Roll-off | -              | @ -3dB                            | 20   | -           | -    | kHz   |
| Transfer Function   | -              | -                                 |      | Positive    |      | -     |

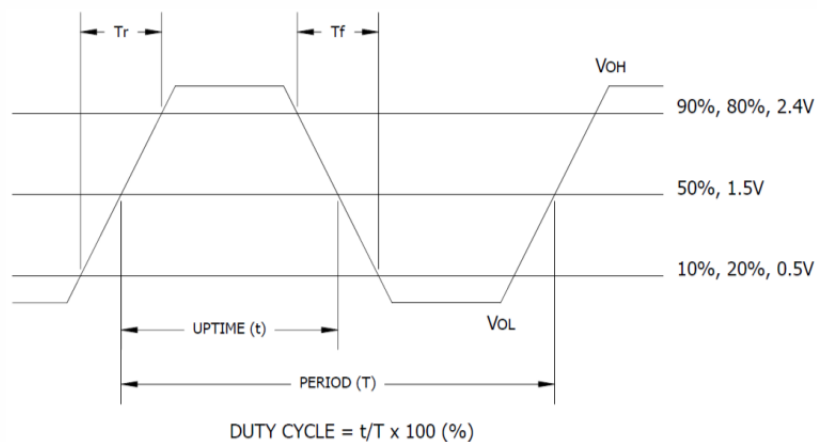
### Test Circuit

HCMOS



### Output Waveform

HCMOS

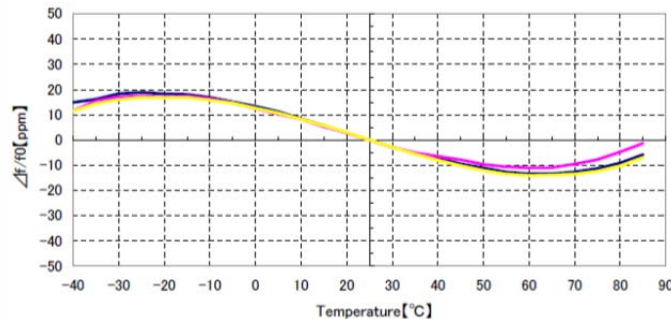


## Electrical Specifications

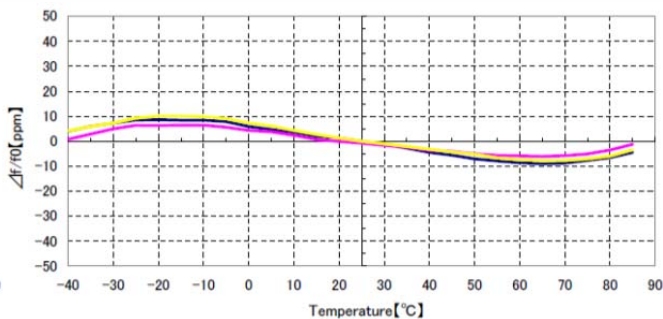
### Performance Data

#### Frequency Deviation – Over Temperature [typical]

122.88MHz,  $V_{CC} = 3.3V$ ,  $V_C = 1.65V$

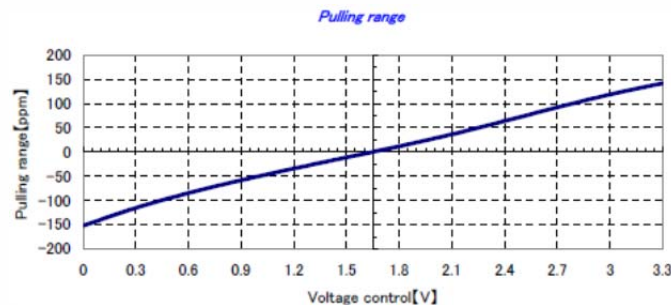


156.25MHz,  $V_{CC} = 3.3V$ ,  $V_C = 1.65V$

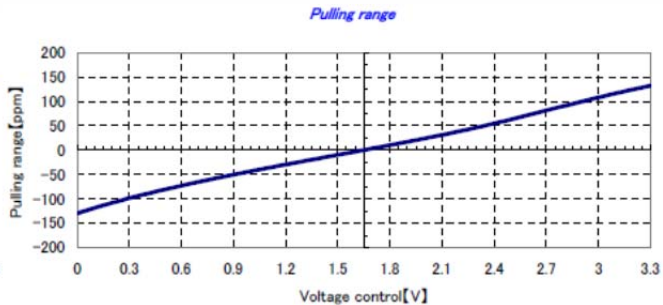


#### Frequency Deviation – Pulling Range [typical]

122.88MHz,  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ V$

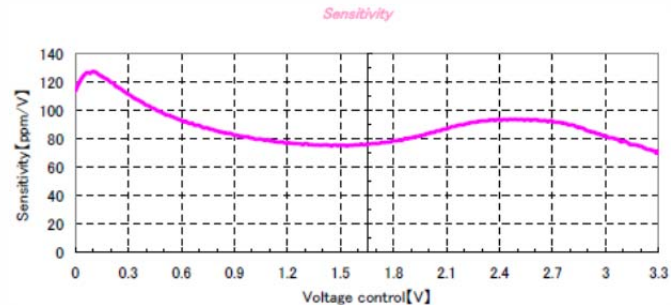


156.25MHz,  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ V$

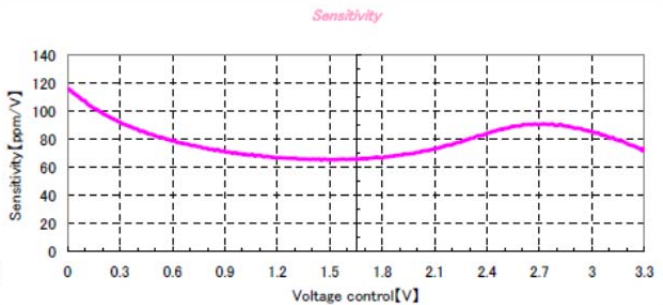


#### Frequency Deviation – Gain Transfer [typical]

122.88MHz,  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ V$



156.25MHz,  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ V$

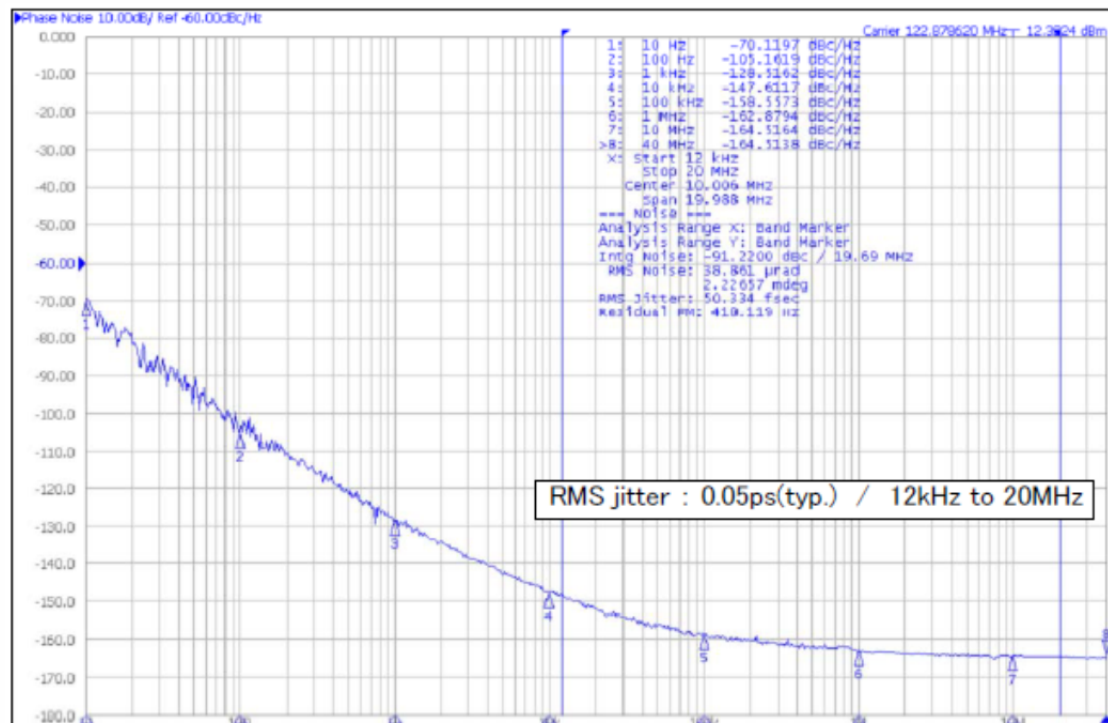


## Electrical Specifications

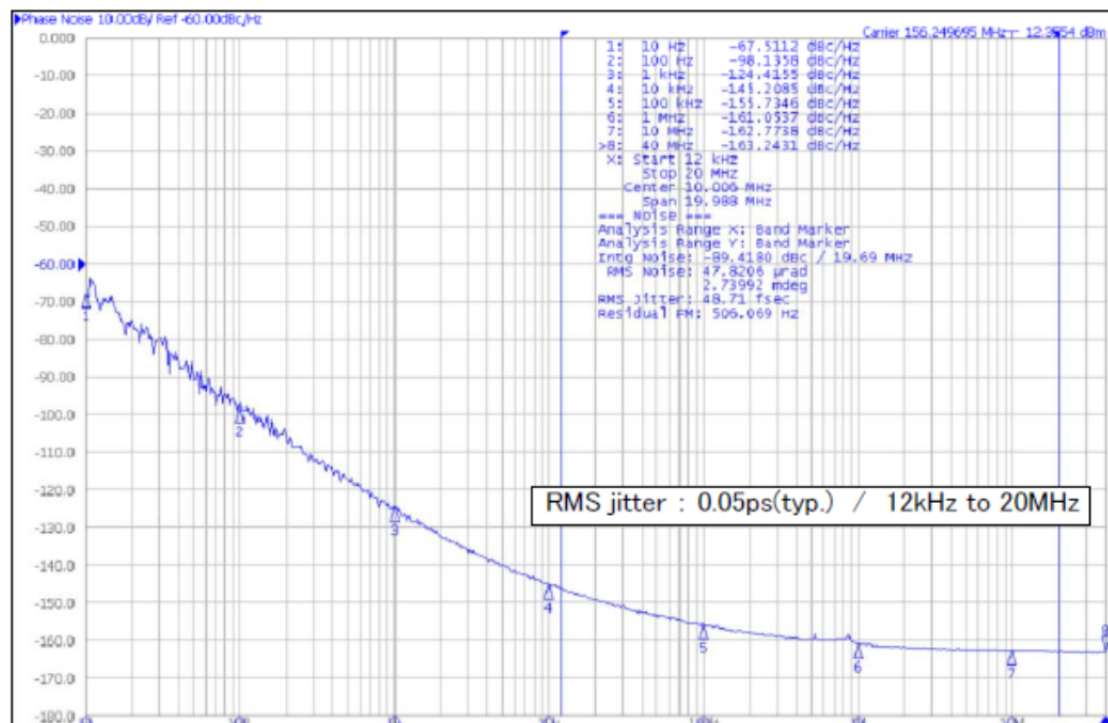
### Performance Data

#### Phase Noise [typical]

122.88MHz,  $V_{CC} = 3.3V$ ,  $V_C = 1.65V$ ,  $T_A = +25^\circ C$

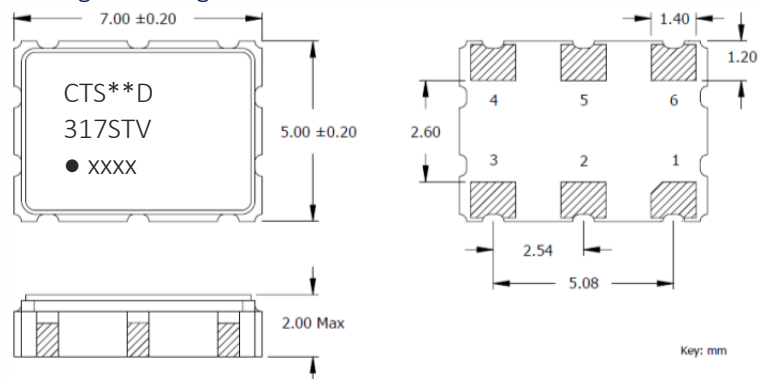


156.25MHz,  $V_{CC} = 3.3V$ ,  $V_C = 1.65V$ ,  $T_A = +25^\circ C$



## Mechanical Specifications

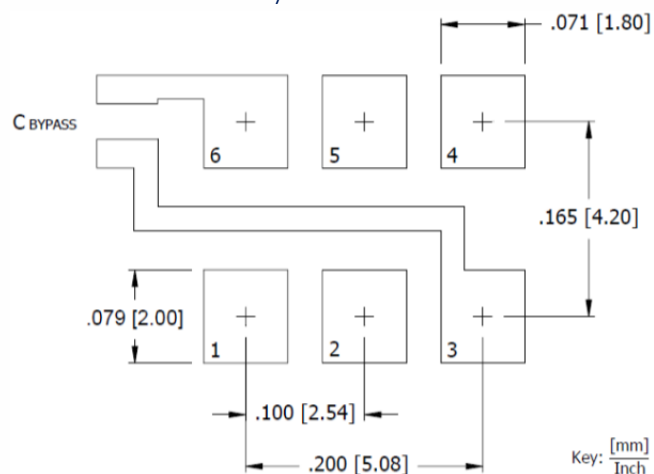
### Package Drawing



### Marking Information

1. \*\* - Manufacturing Site Code.
2. D – Date Code. See Table I for codes.
3. ST – Frequency Stability/Temperature Code. [Refer to Ordering Information]
4. V – Voltage Code. L = 3.3V
5. xxxx – Frequency Code. 4-digits required for frequencies 100MHz and above. [See document 016-1454-0, Frequency Code Tables.]

### Recommended Pad Layout



### Notes

1. Termination pads (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

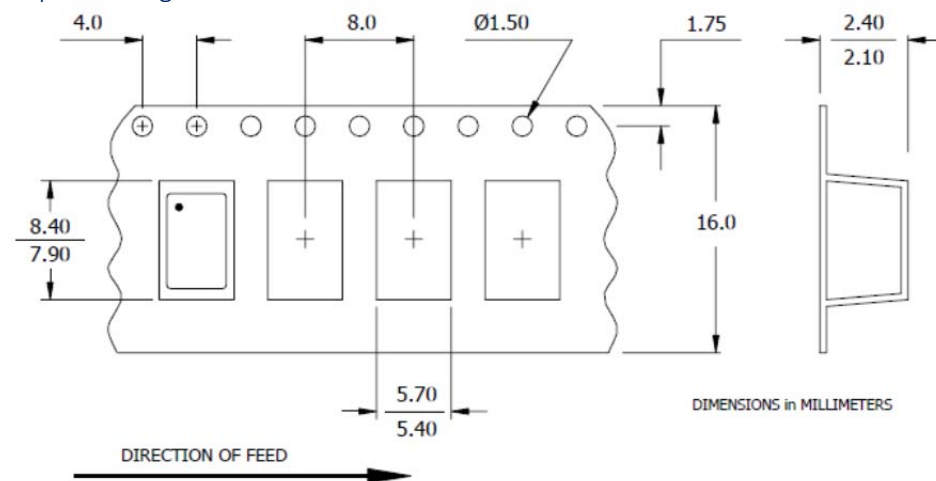
| Pin | Symbol          | Function          |
|-----|-----------------|-------------------|
| 1   | V <sub>C</sub>  | Control Voltage   |
| 2   | EOH             | Enable            |
| 3   | GND             | Circuit & Package |
| 4   | Output          | RF Output         |
| 5   | N.C.            | No Connect        |
| 6   | V <sub>CC</sub> | Supply Voltage    |

Table I - Date Code

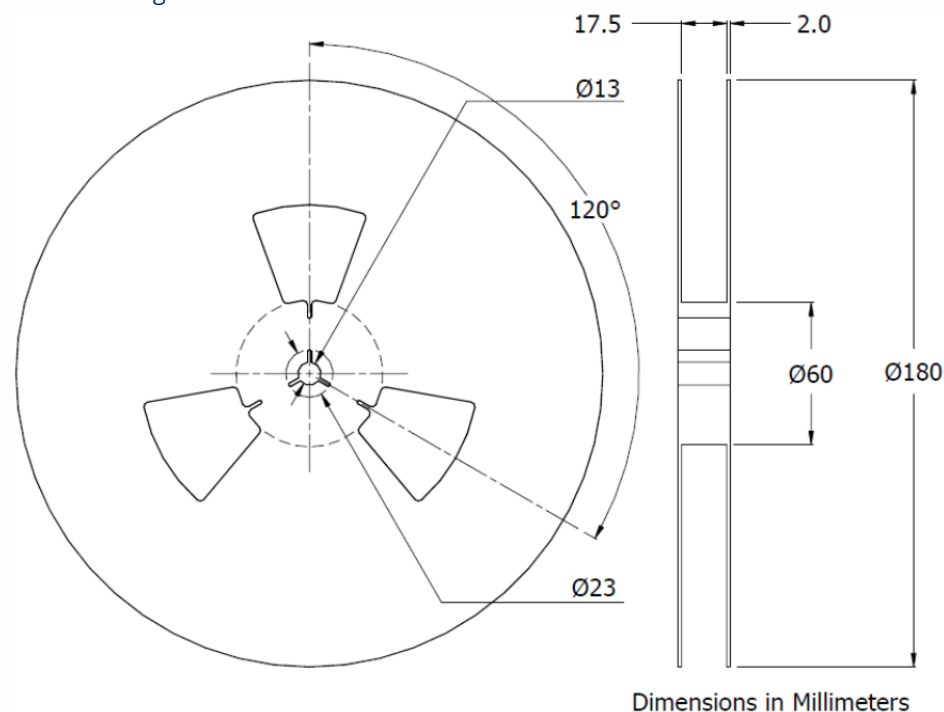
| MONTH |      |      |      |      | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|-------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| YEAR  |      |      |      |      |     |     |     |     |     |     |     |     |     |     |     |     |
| 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   |

## Packaging - Tape and Reel

### Tape Drawing



### Reel Drawing



### Notes

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