



# Model 377

## HFF LVDS VCXO

### Features

- Ceramic Surface Mount Package
- Ultra-Low Phase Jitter Performance
- High Frequency Fundamental Crystal Design
- Frequency Range 100 – 250MHz \*
- +2.5V or +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
- 200.00MHz
- 204.08MHz
- 245.76MHz

\* Check with factory for availability.

### Description

CTS Model 377 is a low cost, small size, high performance VCXO. Employing the latest IC technology, coupled with a high frequency fundamental crystal, M377 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                                                                                                                                     |           |                                                                                                                                                                           |             |      |                |   |                |                                                                                               |        |      |                     |                                                                                                                         |              |  |      |           |                                     |  |
|---------------------------------------------------------------------------------------------------------------------------------|---------------------|---------------------|---------------------|-------------------|----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|----------------|---|----------------|-----------------------------------------------------------------------------------------------|--------|------|---------------------|-------------------------------------------------------------------------------------------------------------------------|--------------|--|------|-----------|-------------------------------------|--|
| 377                                                                                                                             | 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><tr><td>N</td><td>+2.5V ±5%</td></tr></table> |                     | Code                | Voltage             | L                 | +3.3V ±5%            | N                                                                                                                                             | +2.5V ±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%           |                     |                     |                   |                      |                                                                                                                                               |           |                                                                                                                                                                           |             |      |                |   |                |                                                                                               |        |      |                     |                                                                                                                         |              |  |      |           |                                     |  |
| N                                                                                                                               | +2.5V ±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<sup>3</sup></td></tr></table>                                 |                     | Code                | APR                 | B                 | ±50ppm <sup>3</sup>  | <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 <sup>3</sup> |                     |                     |                   |                      |                                                                                                                                               |           |                                                                                                                                                                           |             |      |                |   |                |                                                                                               |        |      |                     |                                                                                                                         |              |  |      |           |                                     |  |
| 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.
- 3] Frequencies ≥200MHz, APR is ±30ppm.

**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  | $V_{CC}$  | -               | -0.3         | -          | 5.0          | V    |
| Maximum Control Voltage | $V_C$     | -               | -0.5         | -          | $V_{CC}$     | V    |
| Supply Voltage          | $V_{CC}$  | $\pm 5\%$       | 3.14<br>2.38 | 3.3<br>2.5 | 3.47<br>2.63 | V    |
| Supply Current          | $I_{CC}$  | LVDS Load       | -            | 20         | 55           | mA   |
| Output Load             | $R_L$     | Between Outputs | -            | 100        | -            | Ohms |
| Operating Temperature   | $T_A$     | -               | -20<br>-40   | +25        | +70<br>+85   | °C   |
| Storage Temperature     | $T_{STG}$ | -               | -40          | -          | +100         | °C   |

### Frequency Stability

| PARAMETER                       | SYMBOL            | CONDITIONS                                      | MIN | TYP          | MAX | UNIT      |
|---------------------------------|-------------------|-------------------------------------------------|-----|--------------|-----|-----------|
| Frequency Range                 | $f_0$             | -                                               |     | 100 - 250    |     | MHz       |
| Frequency Stability<br>[Note 1] | $\Delta f/f_0$    | $\pm 20$ ppm stability, -20°C to +70°C only     |     | 20, 25 or 50 |     | $\pm$ ppm |
| Absolute Pull Range<br>[Note 2] | APR               | Frequencies $\geq 200$ MHz, APR is $\pm 30$ ppm | 50  | -            | -   | $\pm$ ppm |
| Aging                           | $\Delta f/f_{25}$ | First Year @ +25°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                 | -                    | -                                |              | LVDS         |              | -       |
| Output Voltage Levels       | $V_{OH}$<br>$V_{OL}$ | LVDS Load<br>LVDS Load           | -<br>0.90    | 1.43<br>1.10 | 1.60<br>-    | V       |
| Differential Output Voltage | $V_{OD}$             | $R_L = 100$ Ohms                 | 247          | 350          | 454          | mV      |
| Offset Voltage              | $V_{OS}$             | $R_L = 100$ Ohms                 | 1.125        | 1.25         | 1.375        | V       |
| Output Duty Cycle           | SYM                  | @ 1.25V                          | 45           | -            | 55           | %       |
| Rise and Fall Time          | $T_R, T_F$           | @ 20%/80% Levels                 | -            | 0.4          | 1.0          | ns      |
| Start Up Time               | $T_S$                | Application of $V_{CC}$          | -            | 5            | 10           | ms      |
| Enable Function             |                      |                                  |              |              |              |         |
| Enable Input Voltage        | $V_{IH}$             | Pin 2 Logic '1', Output Enabled  | 0.7 $V_{CC}$ | -            | -            | V       |
| Disable Input Voltage       | $V_{IL}$             | Pin 2 Logic '0', Output Disabled | -            | -            | 0.3 $V_{CC}$ | V       |
| Standby Current             | $I_{STB}$            | Pin 2 Logic '0', Output Standby  | -            | -            | 10           | $\mu$ A |
| Enable Time                 | $T_{PLZ}$            | Pin 2 Logic '1'                  | -            | -            | 20           | $\mu$ s |
| Phase Jitter, RMS           | $t_{jrms}$           | Bandwidth 12 kHz - 20 MHz        | -            | 70           | 500          | fs      |
| Phase Noise                 | -                    | See Typical Plots                | -            | -            | -            | -       |

### Electrical Specifications

#### Enable Truth Table

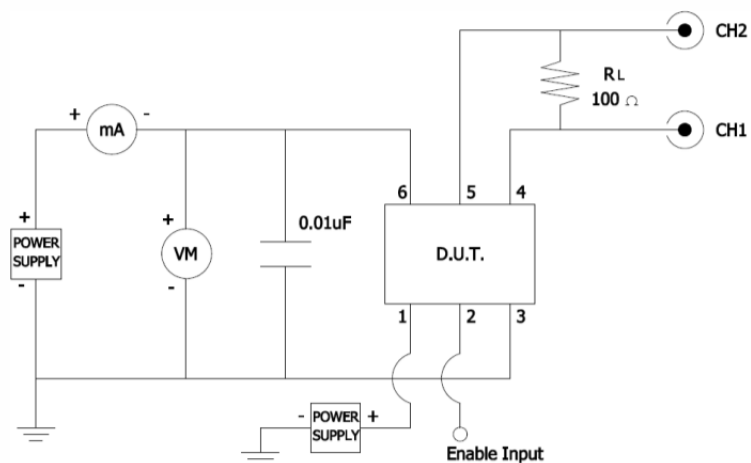
| Pin 2     | Pin 4 & 5 | Pin 2 | Pin 4 & 5 | Pin 2     | Pin 4 & 5 |
|-----------|-----------|-------|-----------|-----------|-----------|
| Logic '1' | Output    | Open  | Output    | Logic '0' | High Imp. |

#### Control Voltage

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

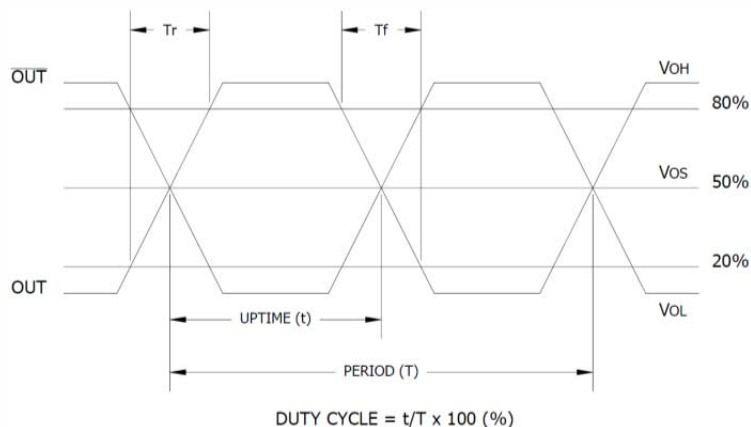
#### Test Circuit

LVDS



#### Output Waveform

LVDS

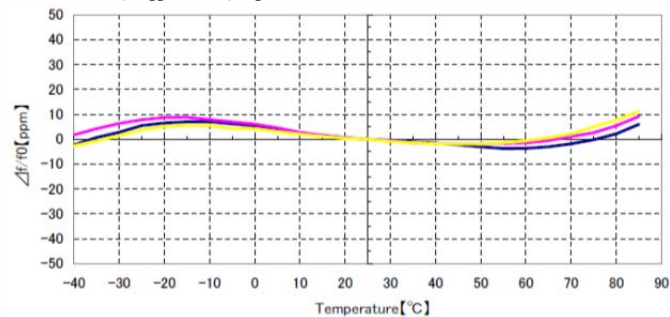


### Electrical Specifications

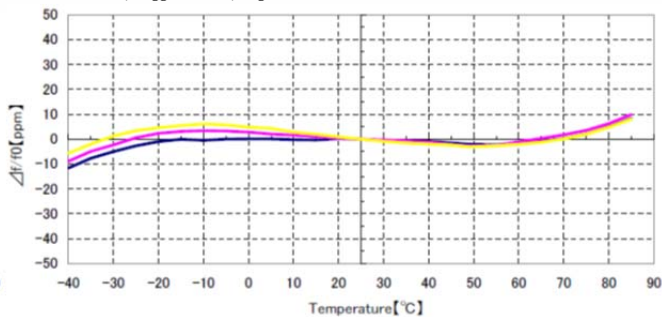
#### Performance Data

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

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

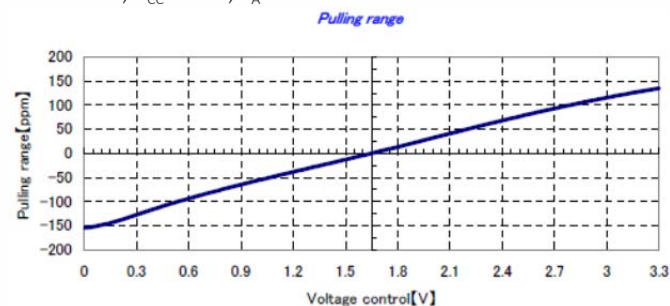


156.25MHz,  $V_{CC} = 3.3V$ ,  $V_C = 1.65V$

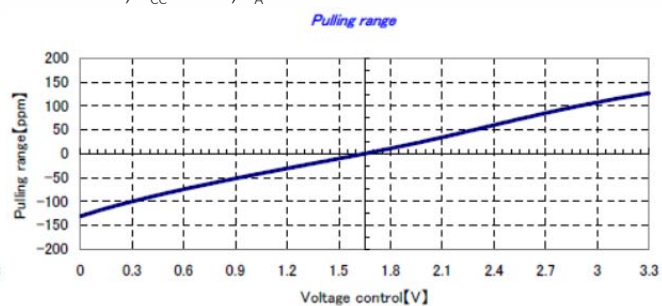


##### Frequency Deviation – Pulling Range [typical]

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

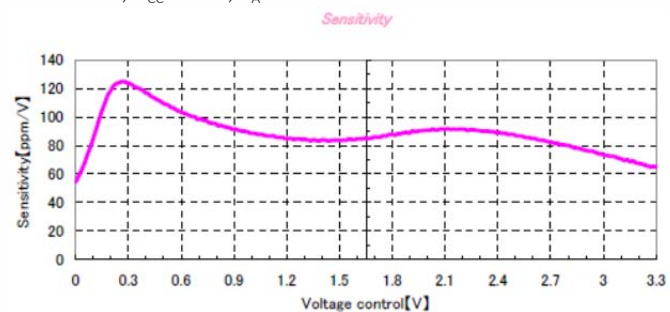


156.25MHz,  $V_{CC} = 3.3V$ ,  $T_A = +25^\circ V$

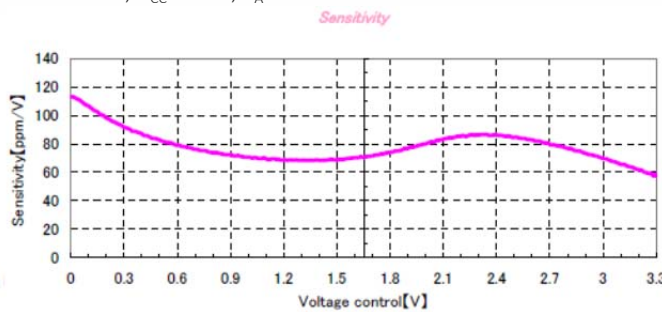


##### Frequency Deviation – Gain Transfer [typical]

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



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

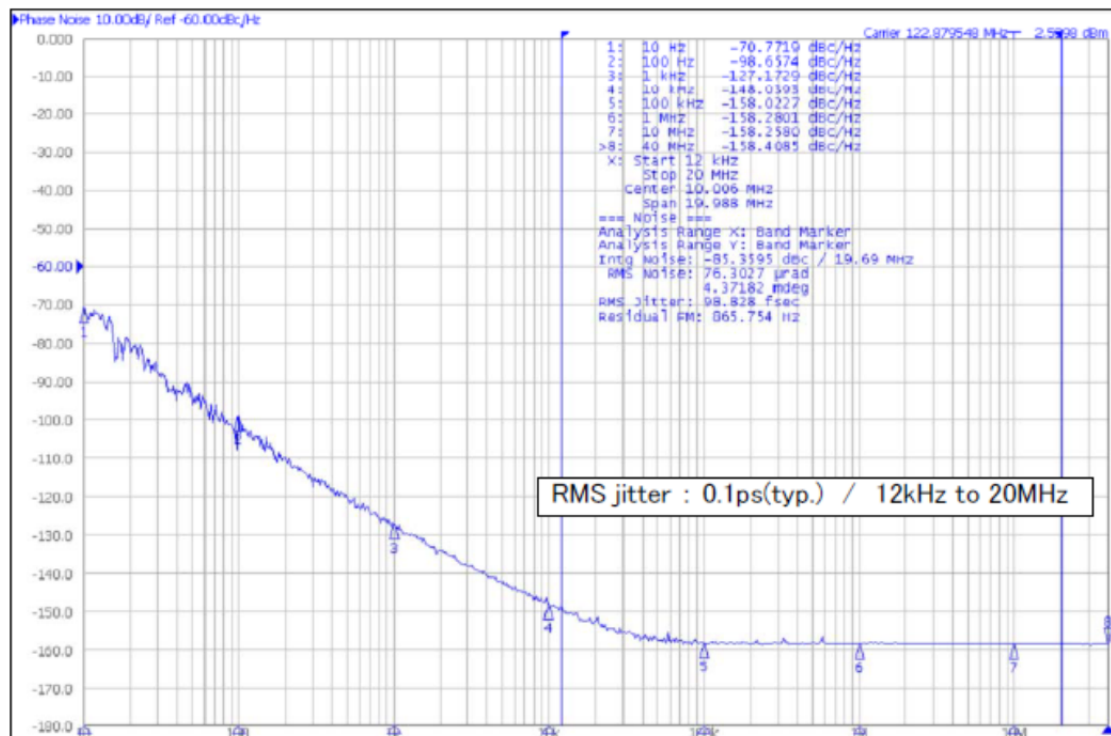


### Electrical Specifications

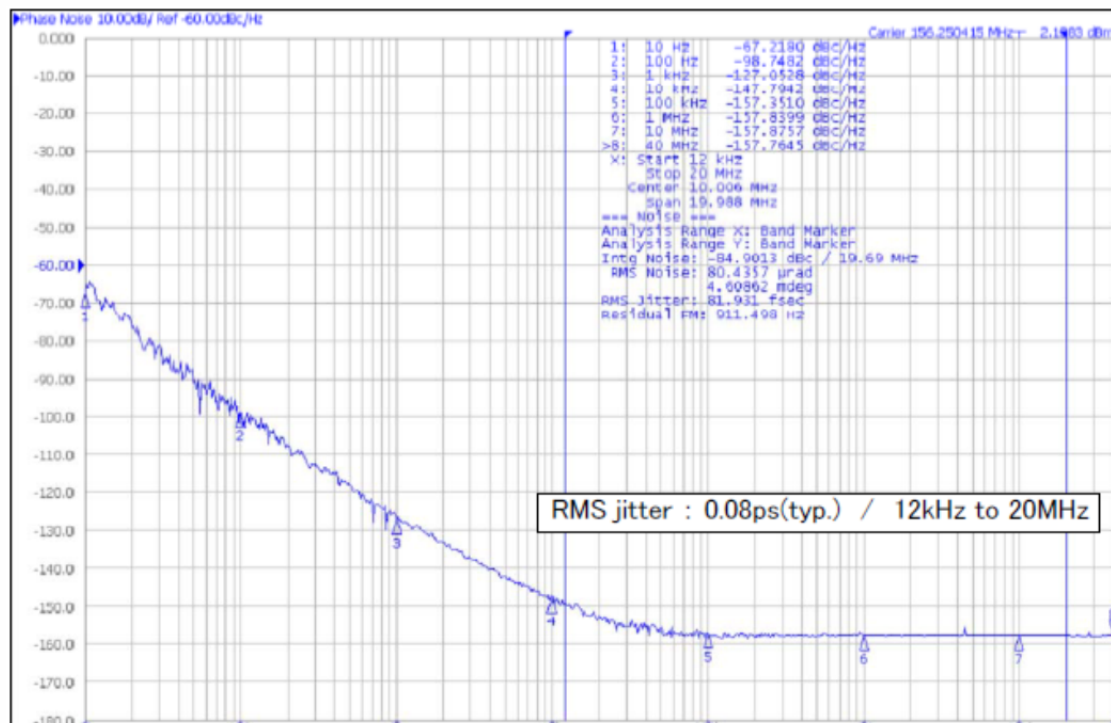
#### Performance Data

##### Phase Noise [typical]

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

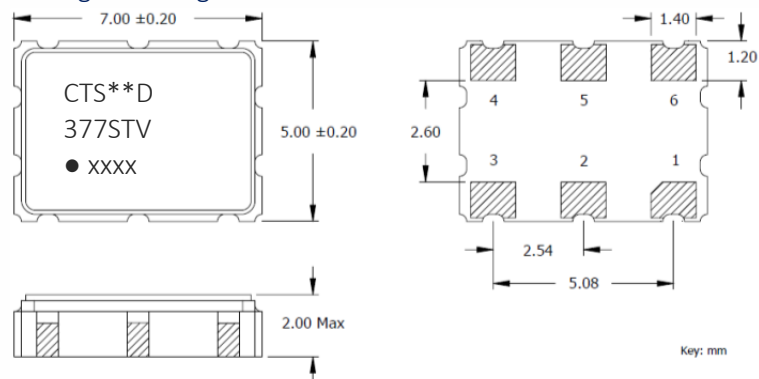


156.25MHz,  $V_{CC} = 3.3V$ ,  $V_C = 1.65V$ ,  $T_A = +25^\circ C$



## Mechanical Specifications

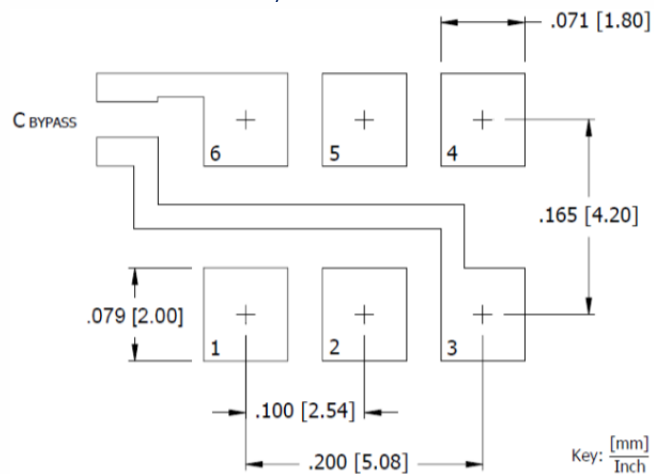
### Package Drawing



### 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, N = 2.5V
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

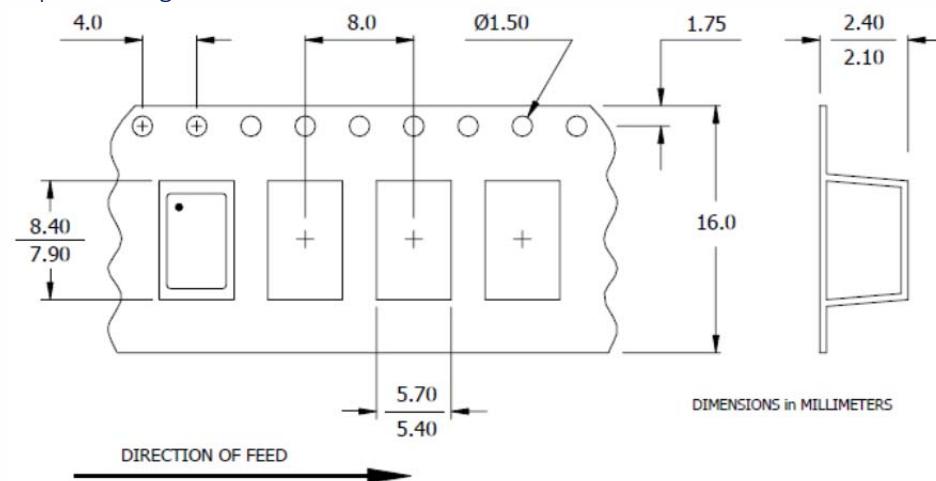
| Pin | Symbol   | Function                 |
|-----|----------|--------------------------|
| 1   | $V_C$    | Control Voltage          |
| 2   | EOH      | Enable                   |
| 3   | GND      | Circuit & Package        |
| 4   | Output   | RF Output                |
| 5   | Output   | RF Output, Complementary |
| 6   | $V_{CC}$ | Supply Voltage           |

Table I - Date Code

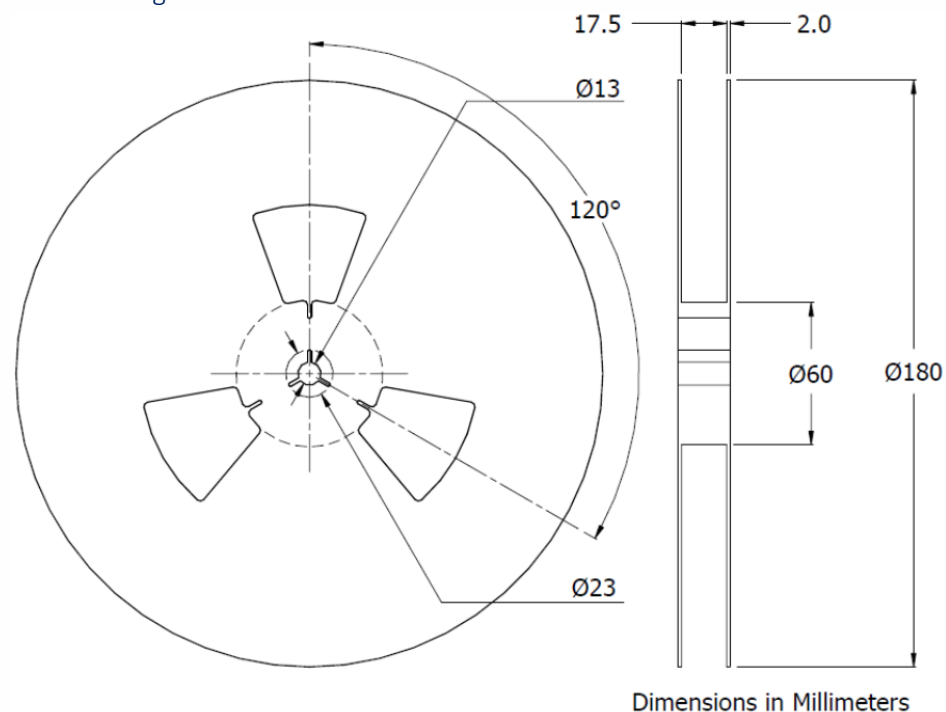
| MONTH |      |      |      |      | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|-------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| YEAR  |      |      |      |      |     |     |     |     |     |     |     | 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

## Данный компонент на территории Российской Федерации

**Вы можете приобрести в компании MosChip.**

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

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