

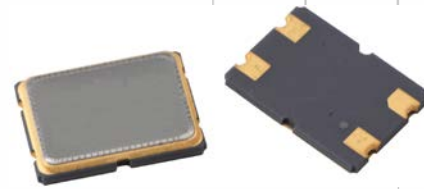


# Model 407

## Surface Mount Quartz Crystal

### Features

- Hermetic Ceramic Surface Mount Package
- Fundamental and 3<sup>rd</sup> Overtone Crystal Design
- Frequency Range 6 – 160MHz
- Frequency Tolerance,  $\pm 30$ ppm Standard
- Frequency Stability,  $\pm 50$ ppm Standard
- Operating Temperature Range to  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Tape and Reel Packaging, EIA-418



Part Dimensions:  
7.0 x 5.0 x 1.3mm • 104.78mg

Standard Frequencies – see Page 5 for common frequencies.  
\* Check with factory for availability of frequencies not listed.

### Applications

- IoT and IIoT Applications
- Wireless Communications
- FPGA/Microcontrollers
- USB Interfaces
- Computer Peripherals
- Portable Equipment
- Test and Measurement
- M2M Communications
- Broadband Access

### Description

CTS Model 407 incorporates a high Q quartz resonator and is ideal for supporting a wide range of commercial and industrial applications.

### Ordering Information

| Model                                                                                                                             | Mode of Oscillation | Tolerance @ +25°C                                                                                                                                                                               | Temperature Stability/Temperature Range |           |                |        |              |        | Load Capacitance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Frequency [MHz] |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
|-----------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|-----------|----------------|--------|--------------|--------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---|--------|--|--|------|-----------|------|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|----------------|------|-------------|----------------|-----|----------------|------|--------|-----|--------|------|---|------|--------|------|--------|------|--------|------|--------|------|--------|--------|--------|---|--------|---|--------|---|--------|---|--------|---|--------|---|--------|--|--|-------------------------------------------------------------------------------------------------------------|------|-----------|------------------------|--|
| 407                                                                                                                               | F                   | 3                                                                                                                                                                                               | 5                                       |           |                |        |              |        | D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | XXXMXXXX        |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| <table><tr><th>Code</th><th>Mode</th></tr><tr><td>F</td><td>Fundamental</td></tr><tr><td>T</td><td>3rd Overtone</td></tr></table> |                     | Code                                                                                                                                                                                            | Mode                                    | F         | Fundamental    | T      | 3rd Overtone |        | <table><tr><th>Code</th><th>Stability</th><th>Code</th><th>Stability</th><th>Code</th><th>Stability</th></tr><tr><th colspan="3">-20°C to +70°C</th><th colspan="2">-30°C to +85°C</th><th>-40°C to +85°C</th></tr><tr><td>1</td><td>±10ppm</td><td>R</td><td>±10ppm</td><td>-</td><td>-</td></tr><tr><td>X</td><td>±15ppm</td><td>Y</td><td>±15ppm</td><td>W</td><td>±15ppm</td></tr><tr><td>2</td><td>±20ppm</td><td>N</td><td>±20ppm</td><td>6</td><td>±20ppm</td></tr><tr><td>3</td><td>±30ppm</td><td>4</td><td>±30ppm</td><td>7</td><td>±30ppm</td></tr><tr><td>5</td><td>±50ppm</td><td>8</td><td>±50ppm</td><td>9</td><td>±50ppm</td></tr></table> |                 |   |        |  |  | Code | Stability | Code | Stability | Code                                                                                                                                                                                                                                                                                                                                                                          | Stability | -20°C to +70°C |      |             | -30°C to +85°C |     | -40°C to +85°C | 1    | ±10ppm | R   | ±10ppm | -    | - | X    | ±15ppm | Y    | ±15ppm | W    | ±15ppm | 2    | ±20ppm | N    | ±20ppm | 6      | ±20ppm | 3 | ±30ppm | 4 | ±30ppm | 7 | ±30ppm | 5 | ±50ppm | 8 | ±50ppm | 9 | ±50ppm |  |  | <table><tr><th>Code</th><th>Frequency</th></tr><tr><td colspan="2">Frequency <sup>1</sup></td></tr></table> | Code | Frequency | Frequency <sup>1</sup> |  |
| Code                                                                                                                              | Mode                |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| F                                                                                                                                 | Fundamental         |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| T                                                                                                                                 | 3rd Overtone        |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| Code                                                                                                                              | Stability           | Code                                                                                                                                                                                            | Stability                               | Code      | Stability      |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| -20°C to +70°C                                                                                                                    |                     |                                                                                                                                                                                                 | -30°C to +85°C                          |           | -40°C to +85°C |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| 1                                                                                                                                 | ±10ppm              | R                                                                                                                                                                                               | ±10ppm                                  | -         | -              |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| X                                                                                                                                 | ±15ppm              | Y                                                                                                                                                                                               | ±15ppm                                  | W         | ±15ppm         |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| 2                                                                                                                                 | ±20ppm              | N                                                                                                                                                                                               | ±20ppm                                  | 6         | ±20ppm         |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| 3                                                                                                                                 | ±30ppm              | 4                                                                                                                                                                                               | ±30ppm                                  | 7         | ±30ppm         |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| 5                                                                                                                                 | ±50ppm              | 8                                                                                                                                                                                               | ±50ppm                                  | 9         | ±50ppm         |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| Code                                                                                                                              | Frequency           |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| Frequency <sup>1</sup>                                                                                                            |                     |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
|                                                                                                                                   |                     | <table><tr><th>Code</th><th>Tolerance</th></tr><tr><td>1</td><td>±10ppm</td></tr><tr><td>X</td><td>±15ppm</td></tr><tr><td>2</td><td>±20ppm</td></tr><tr><td>3</td><td>±30ppm</td></tr></table> | Code                                    | Tolerance | 1              | ±10ppm | X            | ±15ppm | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ±20ppm          | 3 | ±30ppm |  |  |      |           |      |           | <table><tr><th>Code</th><th>Capacitance</th><th>Code</th><th>Capacitance</th></tr><tr><td>K</td><td>8pF</td><td>D</td><td>18pF</td></tr><tr><td>J</td><td>9pF</td><td>E</td><td>20pF</td></tr><tr><td>A</td><td>10pF</td><td>F</td><td>24pF</td></tr><tr><td>L</td><td>12pF</td><td>G</td><td>30pF</td></tr><tr><td>C</td><td>16pF</td><td>S</td><td>Series</td></tr></table> | Code      | Capacitance    | Code | Capacitance | K              | 8pF | D              | 18pF | J      | 9pF | E      | 20pF | A | 10pF | F      | 24pF | L      | 12pF | G      | 30pF | C      | 16pF | S      | Series |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| Code                                                                                                                              | Tolerance           |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| 1                                                                                                                                 | ±10ppm              |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| X                                                                                                                                 | ±15ppm              |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| 2                                                                                                                                 | ±20ppm              |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| 3                                                                                                                                 | ±30ppm              |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| Code                                                                                                                              | Capacitance         | Code                                                                                                                                                                                            | Capacitance                             |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| K                                                                                                                                 | 8pF                 | D                                                                                                                                                                                               | 18pF                                    |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| J                                                                                                                                 | 9pF                 | E                                                                                                                                                                                               | 20pF                                    |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| A                                                                                                                                 | 10pF                | F                                                                                                                                                                                               | 24pF                                    |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| L                                                                                                                                 | 12pF                | G                                                                                                                                                                                               | 30pF                                    |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
| C                                                                                                                                 | 16pF                | S                                                                                                                                                                                               | Series                                  |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |
|                                                                                                                                   |                     |                                                                                                                                                                                                 |                                         |           |                |        |              |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |   |        |  |  |      |           |      |           |                                                                                                                                                                                                                                                                                                                                                                               |           |                |      |             |                |     |                |      |        |     |        |      |   |      |        |      |        |      |        |      |        |      |        |        |        |   |        |   |        |   |        |   |        |   |        |   |        |  |  |                                                                                                             |      |           |                        |  |

Notes:

- 1] Frequency is recorded with 3 leading digits before the "M" and 4 significant digits after the "M" [including zeroes]. (Ex. XXXMXXXX [016M3840], There are frequencies with significant digits after the "M" that exceed the 4 digits. The remaining digits will be truncated from the CTS part number, but the factory will calibrate to the full frequency desired. Examples below; P/N Frequency = Actual Frequency

13M5537 = 13.553750MHz      14M3181 = 14.318180MHz      16M6666 = 16.666670MHz      28M6363 = 28.636360MHz

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

This product is specified for use only in standard commercial applications. Supplier disclaims all express and implied warranties and liability in connection with any use of this product in any non-commercial applications or in any application that may expose the product to conditions that are outside of the tolerances provided in its specification.



## Electrical Specifications

### Operating Conditions

| PARAMETER             | SYMBOL    | CONDITIONS | MIN | TYP | MAX  | UNIT |
|-----------------------|-----------|------------|-----|-----|------|------|
| Operating Temperature | $T_A$     | -          | -20 | +25 | +70  | °C   |
|                       |           |            | -30 |     | +85  |      |
|                       |           |            | -40 |     | +85  |      |
|                       |           |            | -40 |     | +105 |      |
| Storage Temperature   | $T_{STG}$ | -          | -55 | -   | +125 | °C   |

### Frequency Stability

| PARAMETER           | SYMBOL            | CONDITIONS                  | MIN                      | TYP      | MAX | UNIT |
|---------------------|-------------------|-----------------------------|--------------------------|----------|-----|------|
| Frequency Range     | $f_0$             | Fundamental Mode            |                          | 6 - 50   |     | MHz  |
|                     |                   | 3rd Overtone Mode           |                          | 50 - 160 |     | MHz  |
| Frequency Tolerance | $\Delta f/f_0$    | @ +25°C                     | 10, 15, 20, 25 or 30     |          |     | ±ppm |
| Frequency Stability | $\Delta f/f_{25}$ | Referenced to +25°C reading | 10, 15, 20, 25, 30 or 50 |          |     | ±ppm |
| Aging               | $\Delta f/f_0$    | Typical per year @ +25°C    | -3                       | -        | 3   | ppm  |

### Crystal Parameters

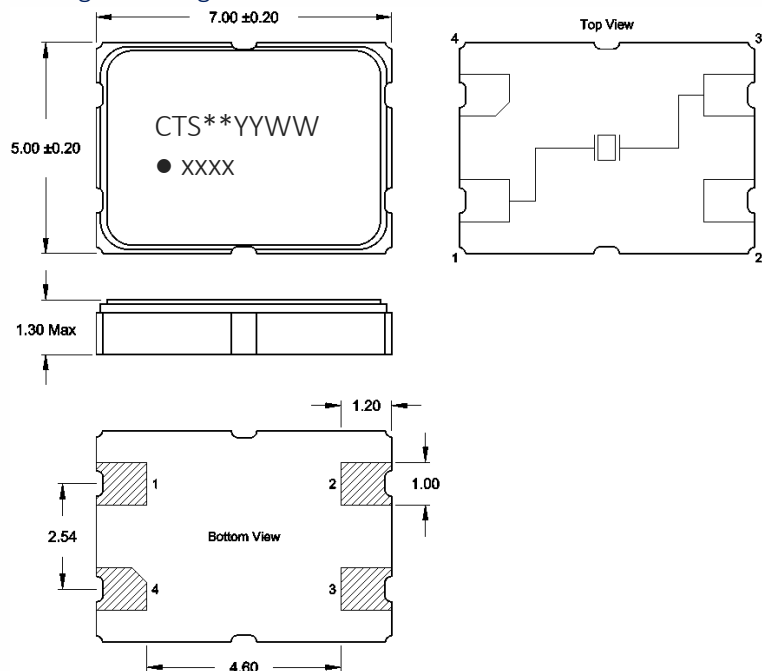
| PARAMETER             | SYMBOL | CONDITIONS      | MIN                        | TYP | MAX | UNIT     |
|-----------------------|--------|-----------------|----------------------------|-----|-----|----------|
| Operating Mode        | -      | -               | Fundamental & 3rd Overtone |     |     | -        |
| Crystal Cut           | -      | -               | AT-Cut Strip               |     |     | -        |
| Load Capacitance      | $C_L$  | -               | See Ordering Information   |     |     | pF       |
| Shunt Capacitance     | $C_0$  | -               | -                          | 5.0 | 7.0 | pF       |
| Series Resistance     |        |                 |                            |     |     |          |
| Fundamental           | $R_1$  | 6MHz - <12MHz   | -                          | -   | 100 | $\Omega$ |
|                       |        | 12MHz - <14MHz  | -                          | -   | 60  |          |
|                       |        | 14MHz - <20MHz  | -                          | -   | 50  |          |
|                       |        | 20MHz - 50MHz   | -                          | -   | 40  |          |
| 3rd Overtone          | $R_1$  | 50MHz - <80MHz  | -                          | -   | 80  | $\Omega$ |
|                       |        | 80MHz - <100MHz | -                          | -   | 70  |          |
|                       |        | 100MHz - 160MHz | -                          | -   | 50  |          |
| Drive Level           | DL     | -               | -                          | 10  | 300 | μW       |
| Insulation Resistance | $R_i$  | +100Vdc ±15Vdc  | 500                        | -   | -   | MΩ       |

$\Delta f/f_0$  - Frequency deviation referenced to nominal frequency.

$\Delta f/f_{25}$  - Frequency deviation over operating temperature range, referenced to +25°C frequency.

## Mechanical Specifications

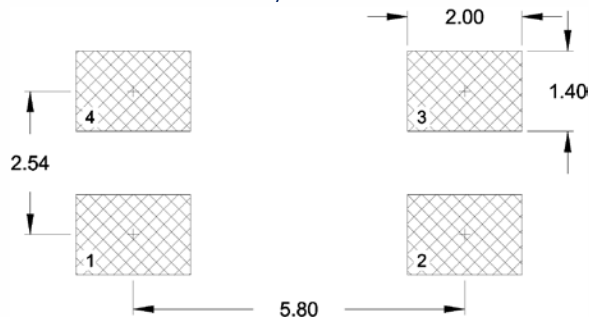
### Package Drawing



### Marking Information

1. \*\* – Manufacturing Site Code.
2. YYWW – Date Code. YY = year, WW = week.
3. xxx or 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

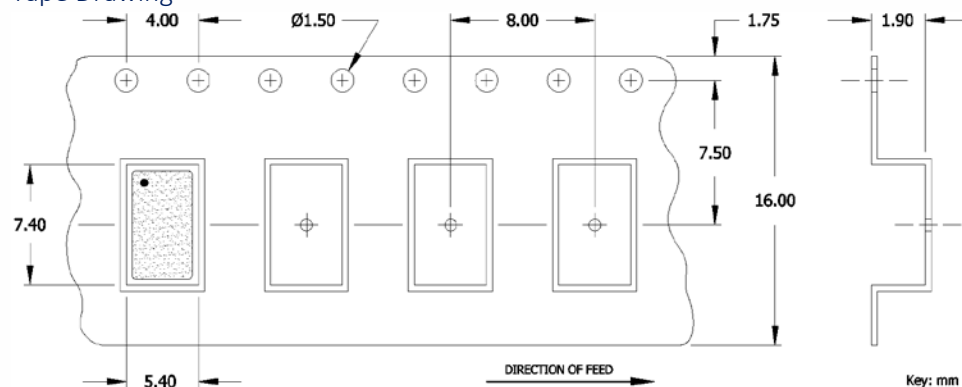


### Notes

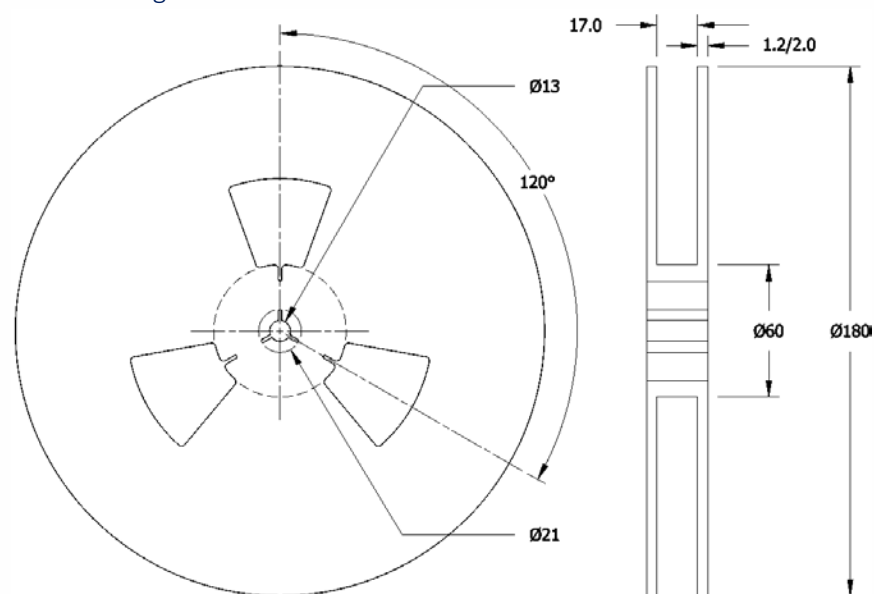
1. JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
2. Terminations #2, #4 and the metal lid are connected internally. End user may connect these pins to circuit ground for EMI suppression.
3. Due to package variability, the pad chamfer on the bottom could be located on Pin 4 in a given lot. Layout orientation should be based on the top view [marking side], as indicated in package drawing. The chamfer location does not affect the electrical performance of the device.
4. Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
5. MSL = 1.

## 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, date code and manufacturing site code information must appear on reel and carton labels.



## Addendum

### Common Frequencies and Frequency Codes – MHz

| Common Wireless Frequencies |                  |              | Additional Frequencies |                  |              |            |                  |              |
|-----------------------------|------------------|--------------|------------------------|------------------|--------------|------------|------------------|--------------|
| FREQUENCY                   | PART NUMBER CODE | MARKING CODE | FREQUENCY              | PART NUMBER CODE | MARKING CODE | FREQUENCY  | PART NUMBER CODE | MARKING CODE |
| 12.000000                   | 012M000          | 120          | 8.000000               | 008M0000         | 80           | 24.553500  | 024M5535         | 24B          |
| 13.560000                   | 013M560          | 13C          | 8.192000               | 008M1920         | 81           | 24.576000  | 024M5760         | 24C          |
| 16.000000                   | 016M000          | 160          | 10.000000              | 010M0000         | 100          | 25.000625  | 025M0006         | 25A          |
| 19.200000                   | 019M200          | 192          | 11.059200              | 011M0592         | 111          | 26.041660  | 026M0416         | 26F          |
| 20.000000                   | 020M000          | 200          | 12.288000              | 012M2880         | 122          | 27.000000  | 027M0000         | 270          |
| 24.000000                   | 024M000          | 240          | 12.500000              | 012M5000         | 125          | 28.224000  | 028M2240         | 282          |
| 25.000000                   | 025M000          | 250          | 12.800000              | 012M8000         | 128          | 28.322000  | 028M3220         | 28C          |
| 26.000000                   | 026M000          | 260          | 12.996000              | 012M9960         | 12C          | 28.375000  | 028M3750         | 283          |
| 27.120000                   | 027M120          | 271          | 13.000000              | 013M0000         | 130          | 28.636360  | 028M6363         | 286          |
| 30.000000                   | 030M000          | 300          | 13.500000              | 013M5000         | 135          | 29.491200  | 029M4912         | 29B          |
| 32.000000                   | 032M000          | 320          | 13.553750              | 013M5537         | 13B          | 30.328000  | 030M3280         | 303          |
| 37.400000                   | 037M400          | 374          | 13.824000              | 013M8240         | 138          | 30.400000  | 030M4000         | 304          |
| 38.400000                   | 038M400          | 384          | 14.000000              | 014M0000         | 140          | 30.720000  | 030M7200         | 307          |
| 40.000000                   | 040M000          | 400          | 14.318180              | 014M3181         | 143          | 31.250000  | 031M2500         | 312          |
| 48.000000                   | 048M000          | 480          | 14.400000              | 014M4000         | 144          | 32.768000  | 032M7680         | 327          |
| 52.000000                   | 052M000          | 520          | 14.745600              | 014M7456         | 147          | 33.000000  | 033M0000         | 330          |
|                             |                  |              | 15.360000              | 015M3600         | 153          | 33.330000  | 033M3300         | 333          |
|                             |                  |              | 16.367600              | 016M3676         | 16E          | 33.333000  | 033M3330         | 33E          |
|                             |                  |              | 16.368000              | 016M3680         | 16C          | 33.333300  | 033M3333         | 33A          |
|                             |                  |              | 16.384000              | 016M3840         | 163          | 33.868800  | 033M8688         | 338          |
|                             |                  |              | 16.666000              | 016M6660         | 166          | 35.000000  | 035M0000         | 350          |
|                             |                  |              | 16.666700              | 016M6667         | 16N          | 35.328000  | 035M3280         | 353          |
|                             |                  |              | 16.667000              | 016M6670         | 16P          | 36.000000  | 036M0000         | 360          |
|                             |                  |              | 16.800000              | 016M8000         | 168          | 38.000000  | 038M0000         | 380          |
|                             |                  |              | 16.934400              | 016M9344         | 169          | 38.880000  | 038M8800         | 388          |
|                             |                  |              | 18.000000              | 018M0000         | 180          | 39.062500  | 039M0625         | 39A          |
|                             |                  |              | 18.432000              | 018M4320         | 184          | 41.600000  | 041M6000         | 41C          |
|                             |                  |              | 19.000000              | 019M0000         | 190          | 44.000000  | 044M0000         | 440          |
|                             |                  |              | 19.440000              | 019M4400         | 194          | 45.000000  | 045M0000         | 450          |
|                             |                  |              | 19.660800              | 019M6608         | 19B          | 49.152000  | 049M1520         | 491          |
|                             |                  |              | 19.680000              | 019M6800         | 196          | 50.000000  | 050M0000         | 500          |
|                             |                  |              | 19.800000              | 019M8000         | 198          | 54.000000  | 054M0000         | 540          |
|                             |                  |              | 20.480000              | 020M4800         | 204          | 114.285000 | 114M2850         | 1142         |
|                             |                  |              | 20.736000              | 020M7360         | 207          | 156.250000 | 156M2500         | 1562         |
|                             |                  |              | 22.000000              | 022M0000         | 220          |            |                  |              |
|                             |                  |              | 22.118400              | 022M1184         | 221          |            |                  |              |
|                             |                  |              | 22.579200              | 022M5792         | 225          |            |                  |              |
|                             |                  |              | 24.305000              | 024M3050         | 243          |            |                  |              |
|                             |                  |              | 24.545400              | 024M5454         | 24F          |            |                  |              |
|                             |                  |              | 24.545454              | 024M5455         | 24G          |            |                  |              |