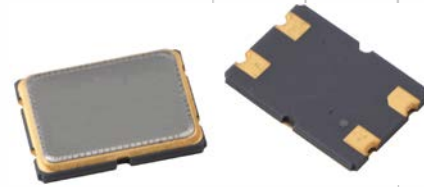


Model 407

Surface Mount Quartz Crystal

Features

- Hermetic Ceramic Surface Mount Package
- Fundamental and 3rd Overtone Crystal Design
- Frequency Range 6 – 160MHz
- Frequency Tolerance, ±30ppm Standard
- Frequency Stability, ±50ppm Standard
- Operating Temperature Range to -40°C to +85°C
- Tape and Reel Packaging, EIA-418



Part Dimensions:
7.0 × 5.0 × 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 |
| | Code Mode | | Code Stability | Code Stability | Code Stability | Code Stability | Code Stability | | Code Frequency | |
| | F Fundamental | | -20°C to +70°C | -30°C to +85°C | -40°C to +85°C | | | | Frequency ¹ | |
| | T 3rd Overtone | | 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 Tolerance | | | | | | Code Capacitance | Code Capacitance | |
| | | 1 ±10ppm | | | | | | K 8pF | D 18pF | |
| | | X ±15ppm | | | | | | J 9pF | E 20pF | |
| | | 2 ±20ppm | | | | | | A 10pF | F 24pF | |
| | | 3 ±30ppm | | | | | | 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 | | +70 | °C |
| | | | -30 | +25 | +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

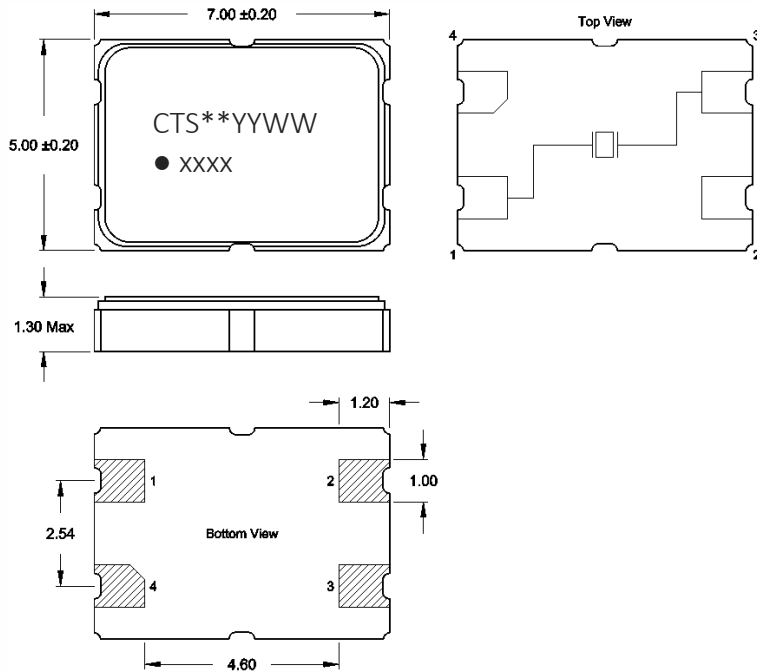
| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------------------|--------|-----------------|----------------------------|-----|-----|----------|
| Operating Mode | - | - | Fundamental & 3rd Overtone | | | - |
| Crystal Cut | - | - | AT-Cut Strip | | | - |
| Load Capacitance | C_L | - | See Ordering Information | | | pF |
| Shunt Capacitance | C_0 | - | - | 5.0 | 7.0 | pF |
| Series Resistance | | | | | | |
| Fundamental | R_1 | 6MHz - <12MHz | - | - | 100 | Ω |
| | | 12MHz - <14MHz | - | - | 60 | |
| | | 14MHz - <20MHz | - | - | 50 | |
| | | 20MHz - 50MHz | - | - | 40 | |
| 3rd Overtone | R_1 | 50MHz - <80MHz | - | - | 80 | Ω |
| | | 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

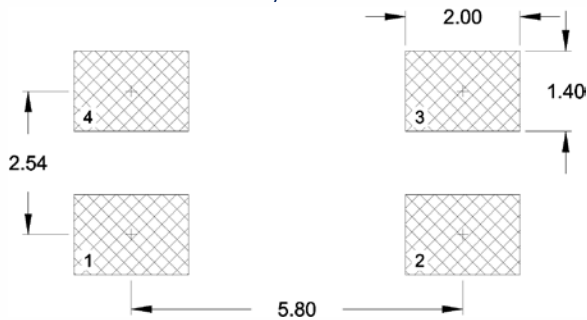
Package Drawing



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

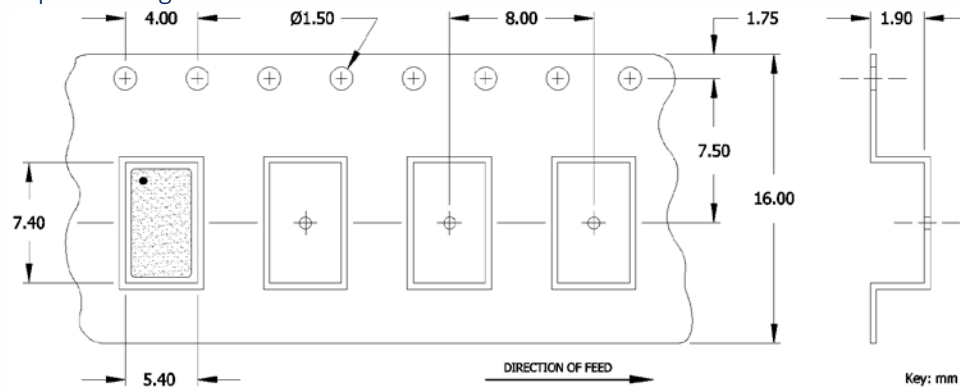


Notes

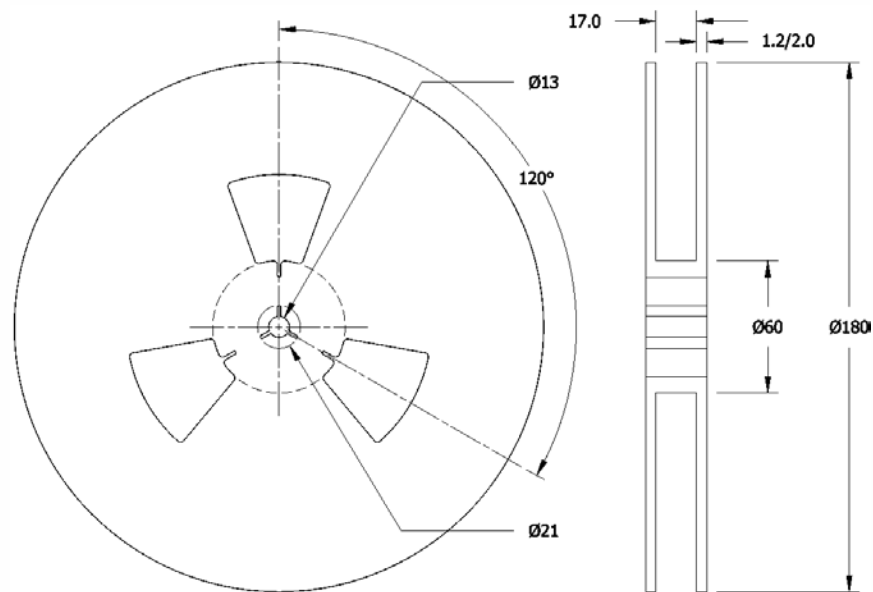
1. JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
2. Terminations #2, #4 and the metal lid are connected internally. End user may connect these pins to circuit ground for EMI suppression.
3. Due to package variability, the pad chamfer on the bottom could be located 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 | | | |

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