# Model 425
## Miniature Surface Mount Crystal
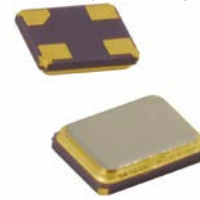
### Features

- Hermetic Ceramic Surface Mount Package
- Fundamental Crystal Design
- Frequency Range 12 – 80MHz
- Frequency Tolerance, ±30ppm Standard
- Frequency Stability, ±30ppm Standard
- Operating Temperature Range to -40°C to +105°C
- Tape and Reel Packaging, EIA-481

Part Dimensions:
2.5 × 2.0 × 0.65mm • 9.00005gm

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
- Wearables

### Description

CTS Model 425 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] |
|-------|---------------------|-------------------|------------------------------------------|------------------|-----------------|
| 425 | F | 3 | 3 | A | XXXMXXXX |

| Code | Mode |
|------|------|
| F | Fundamental |

| Code | Tolerance |
|------|-----------|
| 1 | ±10ppm |
| X | ±15ppm |
| 2 | ±20ppm |
| Y | ±25ppm |
| 3 | ±30ppm |

| Code | Capacitance | Code | Capacitance |
|------|-------------|------|-------------|
| K | 8pF | D | 18pF |
| J | 9pF | E | 20pF |
| A | 10pF | F | 24pF |
| L | 12pF | G | 30pF |
| B | 13pF | S | Series |
| C | 16pF | | |

| -20°C to +70°C | | -30°C to +85°C | | -40°C to +85°C | | -40°C to +105°C | |
|------|-----------|------|-----------|------|-----------|------|-----------|
| Code | Stability | Code | Stability | Code | Stability | Code | Stability |
| 1 | ±10ppm | R | ±10ppm | - | - | - | - |
| X | ±15ppm | Y | ±15ppm | W | ±15ppm | - | - |
| 2 | ±20ppm | N | ±20ppm | 6 | ±20ppm | - | - |
| 3 | ±30ppm | 4 | ±30ppm | 7 | ±30ppm | T | ±30ppm |
| 5 | ±50ppm | 8 | ±50ppm | 9 | ±50ppm | V | ±50ppm |

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

Notes:
1] Frequency is recorded with 3 leading digits before the "M" and 4 significant digits after the "M" [including zeroes]. Frequencies that have 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 | $T_{STG}$ | - | -40 | - | +125 | °C |

## Frequency Stability

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|---|---|---|---|---|---|---|
| Frequency Range | $f_O$ | - | | 12 - 80 | | MHz |
| Frequency Tolerance | $\Delta f/f_O$ | @ +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 | | - |
| Crystal Cut | - | - | | AT-Cut Strip | | - |
| Load Capacitance | $C_L$ | - | | See Ordering Information | | pF |
| Shunt Capacitance | $C_0$ | - | - | 1.0 | 3.0 | pF |
| Series Resistance | | | | | | |
| Fundamental | $R_1$ | 12MHz - <16MHz | - | - | 150 | Ω |
| | | 16MHz - <22MHz | - | - | 100 | |
| | | 22MHz - <30MHz | - | - | 80 | |
| | | 30MHz - <36MHz | - | - | 60 | |
| | | 36MHz - 80MHz | - | - | 50 | |
| Drive Level | DL | - | - | 10 | 200 | 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

M425
Dxxx

2.50 ±0.10

2.00 ±0.10

0.65 Max

0.80

0.70

0.60

0.90

1
2
4
3

Bottom View

Top View

4
3

1
2

4
3

1
2
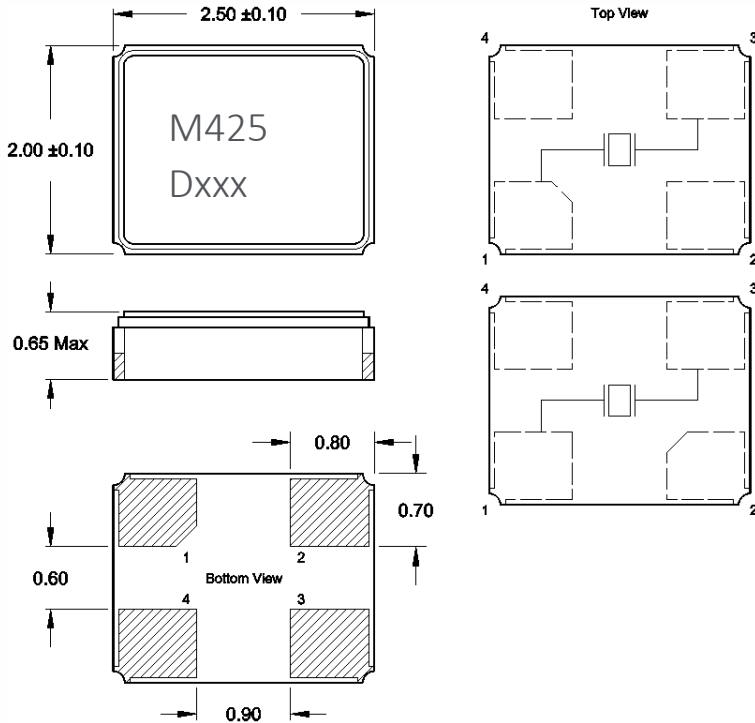
## Marking Information

1. M425 – CTS Model series.
2. D – Date code.  See Table I for codes.
3. xxx – Frequency code, 3-digits frequencies below 100MHz.
[See document 016-1454-0, Frequency Code Tables].

## Recommended Pad Layout

1.10

1.00

1.25

1.65

4
3

1
2

Key: mm

## 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 1 or 2 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.
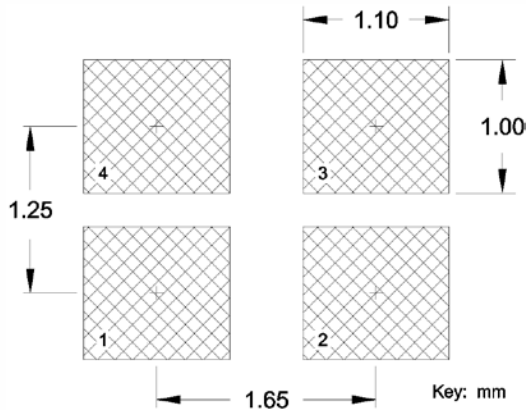4. Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
5. MSL = 1.

## Table I – Date Code, Beginning year 2021

| MONTH | | | | | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| YEAR | | | | | | | | | | | | | | | | |
| 2021 | 2025 | 2029 | 2033 | 2037 | A | B | C | D | E | F | G | H | J | K | L | M |
| 2022 | 2026 | 2030 | 2034 | 2038 | N | P | Q | R | S | T | U | V | W | X | Y | Z |
| 2023 | 2027 | 2031 | 2035 | 2039 | a | b | c | d | e | f | g | h | j | k | l | m |
| 2024 | 2028 | 2032 | 2036 | 2040 | n | p | q | r | s | t | u | v | w | x | y | z |

# Packaging – Tape and Reel

## Tape Drawing



DIRECTION OF FEED

Key: mm
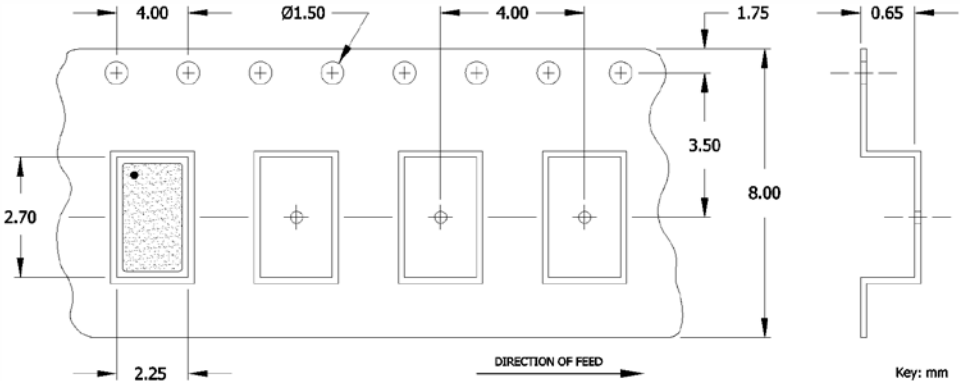
## Reel Drawing
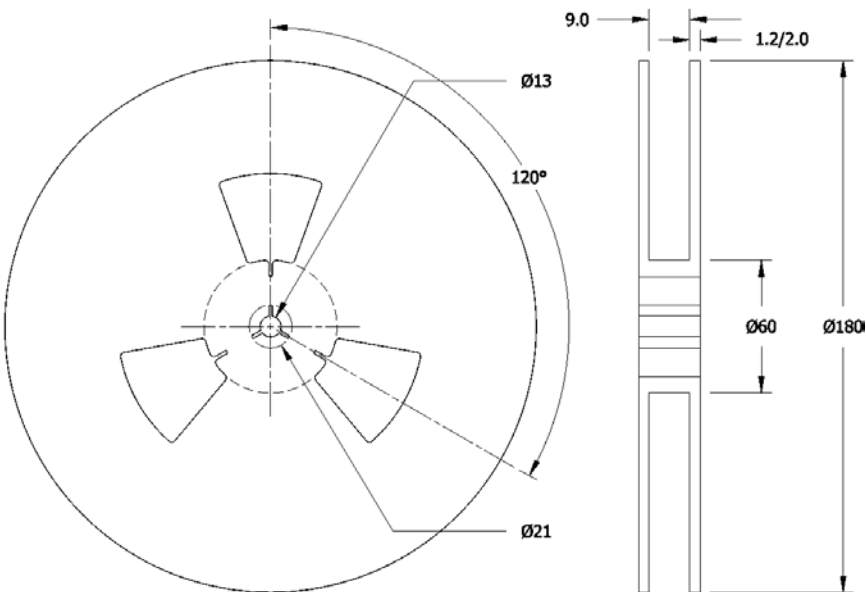


## Notes

1. Device quantity is 1k pieces minimum and 3k 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 | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE |
| 16.000000 | 160 | 16.367600 | 16E | 26.041660 | 26F | 39.062500 | 39A |
| 19.200000 | 192 | 16.384000 | 163 | 27.000000 | 270 | 41.600000 | 41C |
| 20.000000 | 200 | 16.666700 | 16N | 28.224000 | 282 | 44.000000 | 440 |
| 24.000000 | 240 | 16.800000 | 168 | 28.322000 | 28C | 45.000000 | 450 |
| 25.000000 | 250 | 16.934400 | 169 | 28.375000 | 283 | 49.152000 | 491 |
| 26.000000 | 260 | 18.000000 | 180 | 28.636360 | 286 | 50.000000 | 500 |
| 27.120000 | 271 | 18.432000 | 184 | 29.491200 | 29B | 54.000000 | 540 |
| 30.000000 | 300 | 19.440000 | 194 | 30.400000 | 304 | | |
| 32.000000 | 320 | 19.660800 | 19B | 30.720000 | 307 | | |
| 37.400000 | 374 | 19.680000 | 196 | 31.250000 | 312 | | |
| 38.400000 | 384 | 20.480000 | 204 | 32.768000 | 327 | | |
| 40.000000 | 400 | 20.736000 | 207 | 33.000000 | 330 | | |
| 48.000000 | 480 | 22.118400 | 221 | 33.330000 | 333 | | |
| 52.000000 | 520 | 22.579200 | 225 | 33.333000 | 33E | | |
| | | 24.305000 | 243 | 33.333300 | 33A | | |
| | | 24.545400 | 24F | 33.868800 | 338 | | |
| | | 24.545454 | 24G | 35.328000 | 353 | | |
| | | 24.553500 | 24B | 36.000000 | 360 | | |
| | | 24.576000 | 24C | 38.000000 | 380 | | |
| | | 25.000625 | 25A | 38.880000 | 388 | | |