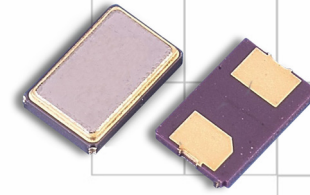


# HS532 Series

## High Temperature Quartz Crystal



Part Dimensions:  
5.0 × 3.2 × 1.1mm • 47mg

### Features

- Hermetic Ceramic Surface Mount Package
- Fundamental and 3<sup>rd</sup> Overtone Crystal Design
- Frequency Range 7.6 – 160MHz
- Frequency Tolerance, ±30ppm Standard
- Frequency Stability, ±50ppm Standard
- Operating Temperature Range to -55°C to +125°C
- Tape and Reel Packaging, EIA-481

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

### Applications

- Industrial IoT [IIoT]
- Industrial Controls
- Commercial Military & Aerospace
- M2M Communication
- Energy Industry
- Test and Measurement

### Description

CTS Model HS532 incorporates a low cost, high Q, small size quartz resonator specifically developed to operate over extended temperature ranges for use in industrial electronics.

### Ordering Information

| Model | Frequency Code [MHz]                                     | Mode of Oscillation                                   | Tolerance @ +25°C  | Temperature Stability  | Temperature Range  | Load Capacitance  | Packaging                            |
|-------|--|---|--|--|--|---|--------------------------------------|
| HS532 | XXX or XXXX  | F   | 3  | 5  | H  | A   | T                                    |
|       | Code    Frequency<br>Product Frequency Code <sup>1</sup> |   | Code    Tolerance<br>1    ±10ppm<br>X    ±15ppm<br>2    ±20ppm<br>3    ±30ppm<br>5    ±50ppm |  | Code    Temp. Range<br>G    -40°C to +105°C <sup>2</sup><br>H    -40°C to +125°C <sup>2</sup><br>N    -40°C to +150°C <sup>3</sup><br>P    -55°C to +105°C <sup>3</sup><br>M    -55°C to +125°C <sup>3</sup> |   | Code    Packing<br>T    1k pcs./reel |
|       |  | Code    Mode<br>F    Fundamental<br>T    3rd Overtone |  | Code    Stability<br>5    ±50ppm<br>6    ±100ppm<br>7    ±150ppm |  | Code    Capacitance    Code    Capacitance<br>V    7pF    C    16pF<br>K    8pF    D    18pF<br>J    9pF    E    20pF<br>A    10pF    F    24pF<br>L    12pF    G    30pF<br>B    13pF    S    Series |                                      |

Notes:

- 1] Refer to document 016-1454-0, Frequency Code Tables. 3-digits for frequencies <100MHz, 4-digits for frequencies 100MHz or greater.
- 2] Available with stability codes 5, 6 and 7.
- 3] Stability codes 6 and 7. Contact factory for code 5 availability.

**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 |                  |            | -40 |     | +125 | °C   |
|                       |                  |            | -40 | +25 | +150 |      |
|                       |                  |            | -55 |     | +105 |      |
|                       |                  |            | -55 |     | +125 |      |
| Storage Temperature   | T <sub>STG</sub> | -          | -55 | -   | +125 | °C   |

### Frequency Stability

| PARAMETER           | SYMBOL             | CONDITIONS                  | MIN | TYP                  | MAX | UNIT |
|---------------------|--------------------|-----------------------------|-----|----------------------|-----|------|
| Frequency Range     | f <sub>0</sub>     | Fundamental mode            |     | 7.6 - 60             |     | MHz  |
|                     |                    | 3rd Overtone mode           |     | 60 - 160             |     | MHz  |
| Frequency Tolerance | Δf/f <sub>0</sub>  | @ +25°C                     |     | 10, 15, 20, 30 or 50 |     | ±ppm |
| Frequency Stability | Δf/f <sub>25</sub> | Referenced to +25°C reading |     | 50, 100 or 150       |     | ±ppm |
| Aging               | Δf/f <sub>0</sub>  | Typical per year @ +25°C    | -3  | -                    | 3   | ppm  |

### Crystal Parameters

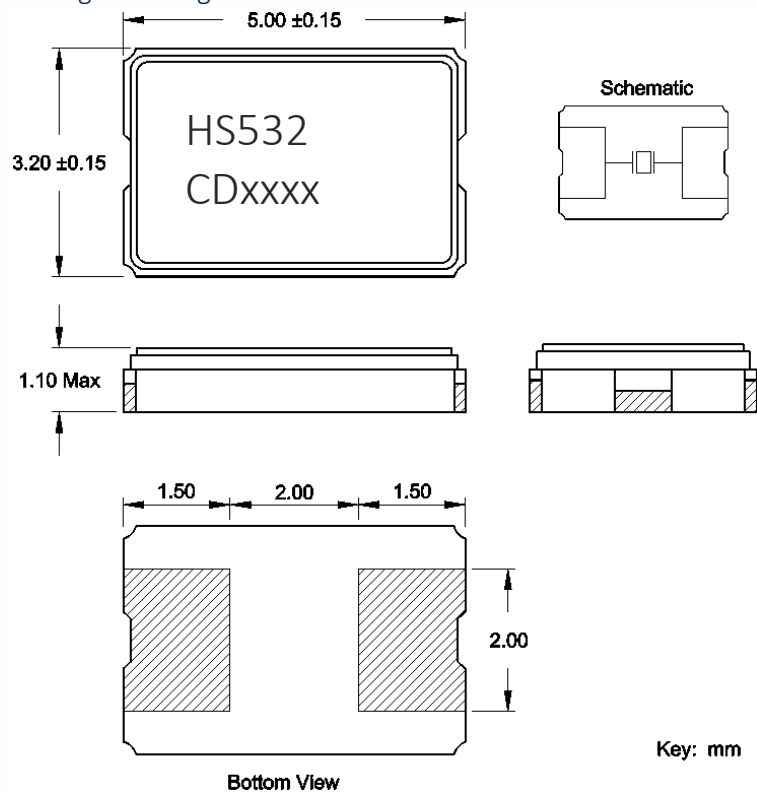
| PARAMETER             | SYMBOL         | CONDITIONS      | MIN                        | TYP | MAX | UNIT |
|-----------------------|----------------|-----------------|----------------------------|-----|-----|------|
| Operating Mode        | -              | -               | Fundamental & 3rd Overtone |     |     | -    |
| Crystal Cut           | -              | -               | AT-Cut Strip               |     |     | -    |
| Load Capacitance      | C <sub>L</sub> | -               | See Ordering Information   |     |     | pF   |
| Shunt Capacitance     | C <sub>0</sub> | -               | -                          | 3.0 | 5.0 | pF   |
| Series Resistance     |                |                 |                            |     |     |      |
| Fundamental           | R <sub>1</sub> | 7.6MHz - <12MHz | -                          | -   | 100 | Ω    |
|                       |                | 12MHz - <14MHz  | -                          | -   | 60  |      |
|                       |                | 14MHz - <20MHz  | -                          | -   | 50  |      |
|                       |                | 20MHz - 60MHz   | -                          | -   | 40  |      |
| 3rd Overtone          | R <sub>1</sub> | 60MHz - 160MHz  | -                          | -   | 80  |      |
| Drive Level           | DL             | -               | -                          | 10  | 300 | μW   |
| Insulation Resistance | R <sub>i</sub> | +100Vdc ±15Vdc  | 500                        | -   | -   | MΩ   |

Δf/f<sub>0</sub> - Frequency deviation referenced to nominal frequency.

Δf/f<sub>25</sub> - Frequency deviation over operating temperature range, referenced to +25°C frequency.

## Mechanical Specifications

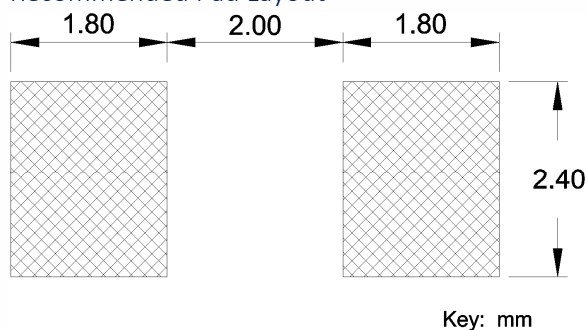
### Package Drawing



### Marking Information

1. HS532 – CTS model.
2. C – CTS.
2. D – Date Code. See Table I for codes.
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

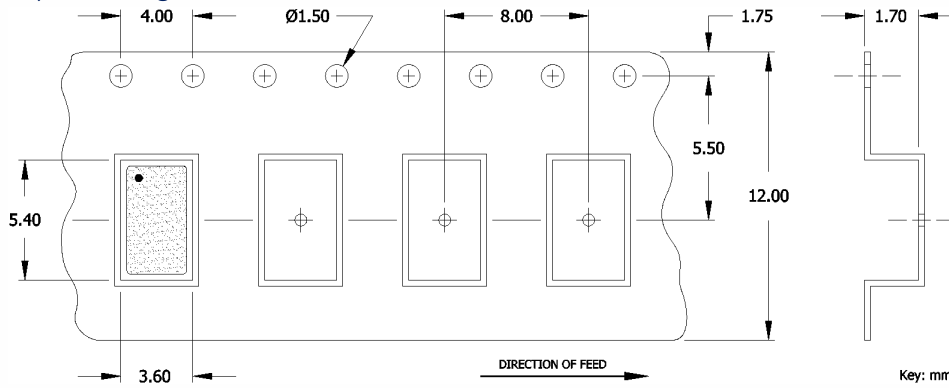
1. JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
2. Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
3. MSL = 1.

Table I - Date Code, Beginning year 2021

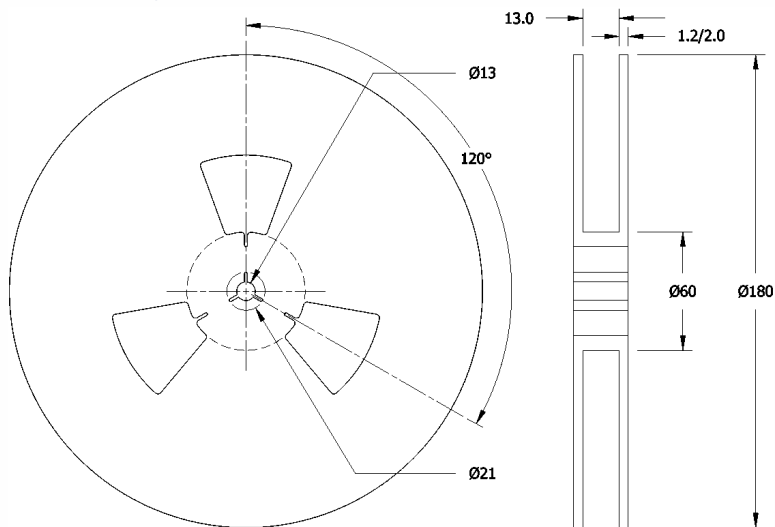
| YEAR |      |      |      |      | MONTH |     |     |     |     |     |     |     |     |     |     |     |
|------|------|------|------|------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|      |      |      |      |      | JAN   | FEB | MAR | APR | MAY | JUN | JUL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



#### 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                   | FREQUENCY CODE | FREQUENCY              | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE | FREQUENCY  | FREQUENCY CODE |
| 12.000000                   | 120            | 8.000000               | 80             | 18.000000 | 180            | 30.328000  | 303            |
| 13.560000                   | 13C            | 8.192000               | 81             | 18.432000 | 184            | 30.400000  | 304            |
| 16.000000                   | 160            | 10.000000              | 100            | 19.000000 | 190            | 30.720000  | 307            |
| 19.200000                   | 192            | 11.059200              | 111            | 19.440000 | 194            | 31.250000  | 312            |
| 20.000000                   | 200            | 12.288000              | 122            | 19.660800 | 19B            | 32.768000  | 327            |
| 24.000000                   | 240            | 12.500000              | 125            | 19.680000 | 196            | 33.000000  | 330            |
| 25.000000                   | 250            | 12.800000              | 128            | 19.800000 | 198            | 33.330000  | 333            |
| 26.000000                   | 260            | 12.996000              | 12C            | 20.480000 | 204            | 33.333000  | 33E            |
| 27.120000                   | 271            | 13.000000              | 130            | 20.736000 | 207            | 33.333300  | 33A            |
| 30.000000                   | 300            | 13.500000              | 135            | 22.000000 | 220            | 33.868800  | 338            |
| 32.000000                   | 320            | 13.553750              | 13B            | 22.118400 | 221            | 35.000000  | 350            |
| 37.400000                   | 374            | 13.824000              | 138            | 22.579200 | 225            | 35.328000  | 353            |
| 38.400000                   | 384            | 14.000000              | 140            | 24.305000 | 243            | 36.000000  | 360            |
| 40.000000                   | 400            | 14.318180              | 143            | 24.545400 | 24F            | 38.000000  | 380            |
| 48.000000                   | 480            | 14.400000              | 144            | 24.545454 | 24G            | 38.880000  | 388            |
| 52.000000                   | 520            | 14.745600              | 147            | 24.553500 | 24B            | 39.062500  | 39A            |
|                             |                | 15.360000              | 153            | 24.576000 | 24C            | 41.600000  | 41C            |
|                             |                | 16.367600              | 16E            | 25.000625 | 25A            | 44.000000  | 440            |
|                             |                | 16.368000              | 16C            | 26.041660 | 26F            | 45.000000  | 450            |
|                             |                | 16.384000              | 163            | 27.000000 | 270            | 49.152000  | 491            |
|                             |                | 16.666000              | 166            | 28.224000 | 282            | 50.000000  | 500            |
|                             |                | 16.666700              | 16N            | 28.322000 | 28C            | 54.000000  | 540            |
|                             |                | 16.667000              | 16P            | 28.375000 | 283            | 114.285000 | 1142           |
|                             |                | 16.800000              | 168            | 28.636360 | 286            | 156.250000 | 1562           |
|                             |                | 16.934400              | 169            | 29.491200 | 29B            |            |                |