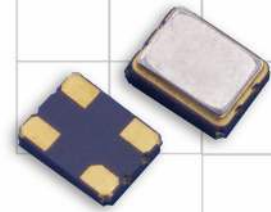


# Model CA32C

## AUTOMOTIVE GRADE HCMOS CLOCK



Part Dimensions:  
3.2 × 2.5 × 1.2mm • 30.803mg

### Features

- AEC-Q200 Compliant
- Ceramic Surface Mount Package
- Operating Temperature Range to -55°C to +105°C
- Fundamental and 3<sup>rd</sup> Overtone Crystal Designs
- Frequency Range 1.25 – 156.25MHz \*
- +1.8V, +2.5V and +3.3V Operation
- Output Enable Standard
- Tape and Reel Packaging, EIA-481

### Standard Frequencies

\* See Page 6 for common frequencies.  
Check with factory for availability of frequencies not listed.

### Applications

- Automotive Electronics
- Mobile Multimedia/Infotainment
- IoT and IIoT
- Wireless Communication
- Medical Electronics
- Commercial Military & Aerospace

### Description

CTS Model CA32C is a low cost, small size, Clock Oscillator [XO] developed for use in automotive electronics operating over extended temperature ranges. CA32C has an HCMOS/TTL compatible output, offers excellent stability and low jitter/phase noise performance.

### Ordering Information

| Model             |           | Output Type                         | Frequency Code [MHz] | Frequency Stability            | Temperature Range | Supply Voltage | Packaging |
|-------------------|-----------|-------------------------------------|----------------------|--------------------------------|-------------------|----------------|-----------|
| CA                | 32        | C                                   | XXX or XXXX          | 3                              | G                 | L              | R         |
| Code Package Size |           | Code Frequency                      |                      | Code Temp. Range               |                   | Code Packing   |           |
| 32                | 3.2x2.5mm | Product Frequency Code <sup>1</sup> |                      | I -40°C to +85°C               |                   | R 3k pcs./reel |           |
| Code Output       |           | Code Stability                      |                      | G -40°C to +105°C <sup>2</sup> |                   | Code Voltage   |           |
| C                 | HCMOS     | 3 ±50ppm                            |                      | H -40°C to +125°C <sup>3</sup> |                   | M +1.8Vdc      |           |
| Code Output       |           | Code Stability                      |                      | N -40°C to +150°C <sup>4</sup> |                   | N +2.5Vdc      |           |
| C                 | HCMOS     | 2 ±100ppm                           |                      | P -55°C to +105°C <sup>4</sup> |                   | L +3.3Vdc      |           |
| Code Output       |           | Code Stability                      |                      | Code Stability                 |                   | Code Voltage   |           |
| C                 | HCMOS     | 5 ±25ppm                            |                      | 3 ±50ppm                       |                   | M +1.8Vdc      |           |
| C                 | HCMOS     | 4 ±30ppm                            |                      | 2 ±100ppm                      |                   | N +2.5Vdc      |           |
| C                 | HCMOS     | 4 ±30ppm                            |                      | 2 ±100ppm                      |                   | L +3.3Vdc      |           |

#### 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 4, 3, 2 and 7.
- 3] Available with stability codes 3, 2 and 7.
- 4] Stability codes 2 and 7. Contact factory for 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 |
|---|-----------|------------|-------|-----|-------|------|
| Maximum Supply Voltage  | $V_{CC}$  | -          | -0.5  | -   | 4.0   | V    |
| Supply Voltage  | $V_{CC}$  | ±5%        | 1.710 | 1.8 | 1.890 | V    |
|   |           |            | 2.375 | 2.5 | 2.665 |      |
|   |           |            | 3.135 | 3.3 | 3.465 |      |
| Typical @ Nominal $V_{CC}$ , $C_L = 15$ pF, $T_A = +25^\circ\text{C}$ |           |            |       |     |       |      |
| Supply Current  | $I_{CC}$  | @ +1.8V    | -     | 15  | 40    | mA   |
|   |           | @ +2.5V    | -     | 20  | 40    |      |
|   |           | @ +3.3V    | -     | 20  | 40    |      |
| Output Load   | $C_L$     | -          | -     | -   | 15    | pF   |
| Operating Temperature   | $T_A$     | -          | -40   | -   | +85   | °C   |
|   |           |            | -40   | -   | +105  |      |
|   |           |            | -40   | +25 | +125  |      |
|   |           |            | -55   | -   | +150  |      |
|   |           |            | -55   | -   | +105  |      |
| Storage Temperature   | $T_{STG}$ | -          | -55   | -   | +125  | °C   |

### Frequency Stability

| PARAMETER                       | SYMBOL            | CONDITIONS                           | MIN | TYP                    | MAX | UNIT |
|---------------------------------|-------------------|--------------------------------------|-----|------------------------|-----|------|
| Frequency Range                 | $f_0$             | -                                    |     | 1.25 - 156.25          |     | MHz  |
| Frequency Stability<br>[Note 1] | $\Delta f/f_0$    | -                                    |     | 25, 30, 50, 100 or 150 |     | ±ppm |
| Aging                           | $\Delta f/f_{25}$ | First Year @ +25°C, nominal $V_{CC}$ | -5  | -                      | 5   | ppm  |

1.] Inclusive of initial tolerance at time of shipment, changes in supply voltage, load, temperature and 1st year aging.

### Output Parameters

| PARAMETER  | SYMBOL     | CONDITIONS                               | MIN         | TYP   | MAX         | UNIT |
|--|------------|--|-------------|-------|-------------|------|
| Output Type  | -          | -  |             | HCMOS |             | -    |
| Output Voltage Levels                              | $V_{OH}$   | Logic '1' Level, CMOS Load               | $0.9V_{CC}$ | -     | -           | V    |
|  | $V_{OL}$   | Logic '0' Level, CMOS Load               | -           | -     | $0.1V_{CC}$ |      |
| Output Current Levels                              | $I_{OH}$   | $V_{OH} = 90\%V_{CC}$ [1.8V, 2.5V, 3.3V] | -           | -     | -4, -4, -8  | mA   |
|  | $I_{OL}$   | $V_{OL} = 10\%V_{CC}$ [1.8V, 2.5V, 3.3V] | -           | -     | +4, +4, +8  |      |
| Output Duty Cycle                                  | SYM        | @ 50% Level                              | 45          | -     | 55          | %    |
| @ 10%/90% Levels, Nominal $V_{CC}$ , $C_L = 15$ pF |            |  |             |       |             |      |
| Rise and Fall Time<br>[Note 2]                     | $T_R, T_F$ | @ +1.8V                                  | -           | 5     | 7           | ns   |
|  |            | @ +2.5V                                  | -           | 5     | 7           |      |
|  |            | @ +3.3V                                  | -           | 5     | 7           |      |
| Start Up Time                                      | $T_S$      | Application of $V_{CC}$                  | -           | 2     | 5           | ms   |

2.] Parameters are worst case and account for comprehensive range of product specification. Performance may vary by application and must be validated by end user.

## Electrical Specifications

### Output Parameters

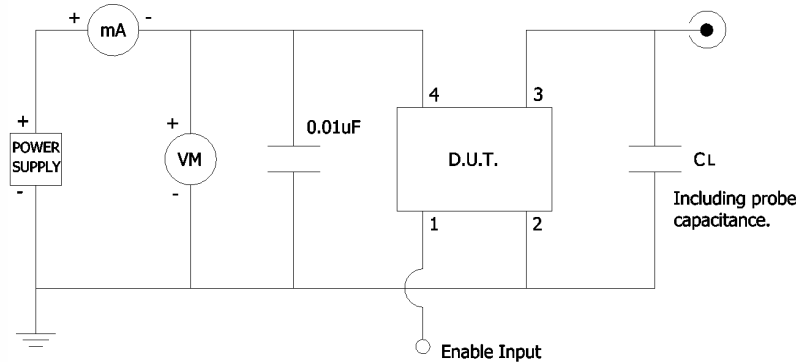
| PARAMETER             | SYMBOL     | CONDITIONS                      | MIN         | TYP | MAX         | UNIT    |
|-----------------------|------------|---------------------------------|-------------|-----|-------------|---------|
| Enable Function       |            | Standby                         |             |     |             |         |
| Enable Input Voltage  | $V_{IH}$   | Pin 1 Logic '1', Output Enabled | $0.7V_{CC}$ | -   | -           | V       |
| Disable Input Voltage | $V_{IL}$   | Pin 1 Logic '0', Output Standby | -           | -   | $0.3V_{CC}$ | V       |
| Enable Current        | $I_{STB}$  | Pin 1 Logic '0', Output Standby | -           | -   | 10          | $\mu A$ |
| Enable Time           | $T_{PLZ}$  | Pin 1 Logic '1'                 | -           | -   | 5           | ms      |
| Phase Jitter, RMS     | $t_{jrms}$ | Bandwidth 12 kHz - 20 MHz       | -           | 0.5 | <1          | ps      |

### Enable Truth Table

| Pin 1     | Pin 3                              |
|-----------|------------------------------------|
| Logic '1' | Output Enabled                     |
| Open      | Output Enabled                     |
| Logic '0' | Output Disabled,<br>High Impedance |

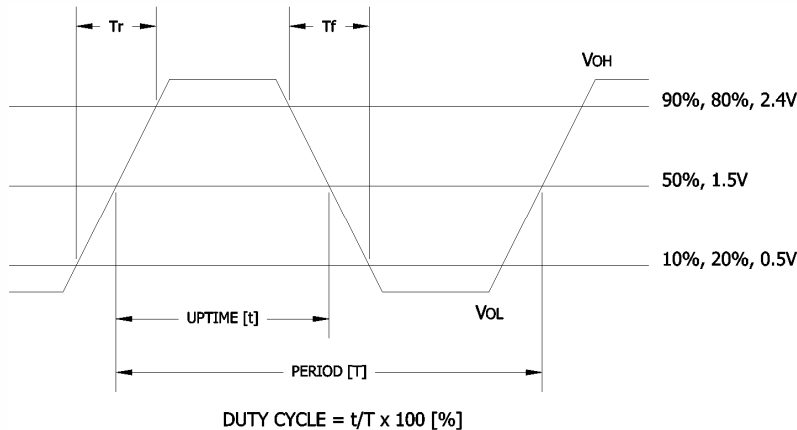
### Test Circuit

HCMOS



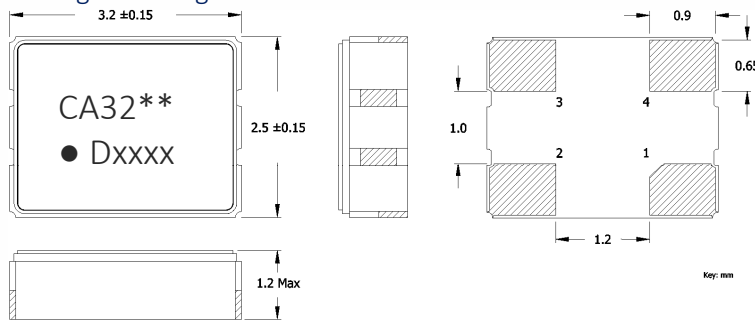
### Output Waveform

HCMOS



## Mechanical Specifications

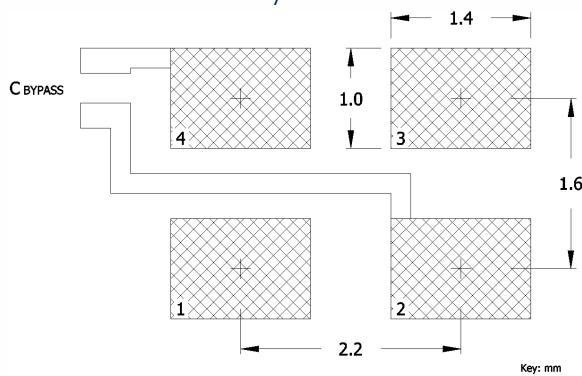
### Package Drawing



### Marking Information

1. CA32 – CTS model.
  2. \*\* – Manufacturing Site Code.
  3. ● – Pin 1 identifier.
  4. D – Date Code. See Table I for codes.
  5. xxxx – Frequency Code.  
3-digits for frequencies <100MHz  
4-digits for frequencies 100MHz or greater
- [See document 016-1454-0, Frequency Code Tables.]

### Recommended Pad Layout



### Notes

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

### Pin Assignments

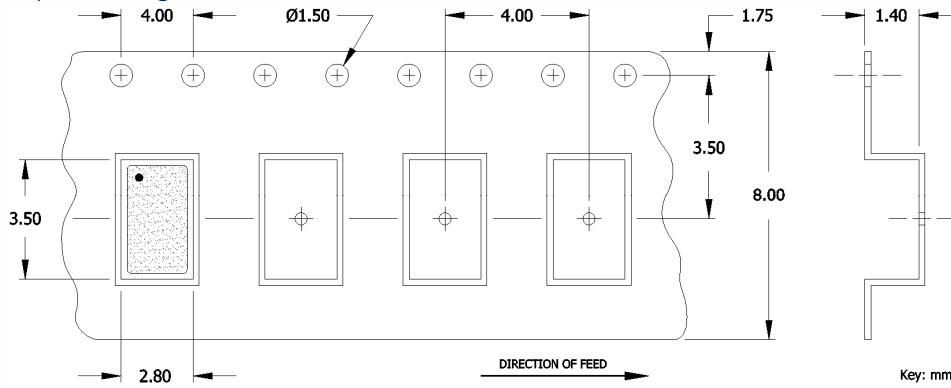
| Pin | Symbol          | Function          |
|-----|-----------------|-------------------|
| 1   | EOH             | Enable            |
| 2   | GND             | Circuit & Package |
| 3   | Output          | RF Output         |
| 4   | V <sub>CC</sub> | Supply Voltage    |

Table I - Date Code, Beginning year 2021

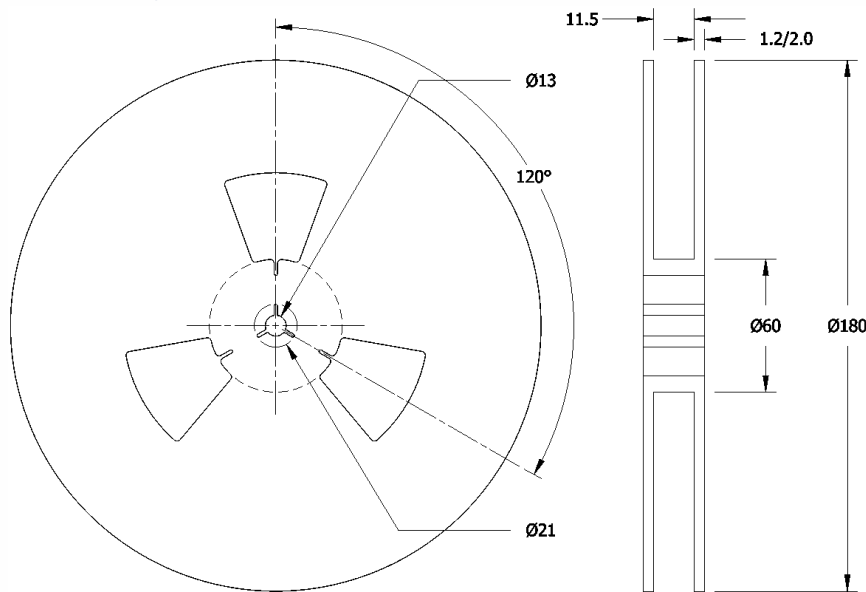
|      |      | MONTH |      |      |     |     | YEAR |     |     |     |     |     |     |   |   |   |
|------|------|-------|------|------|-----|-----|------|-----|-----|-----|-----|-----|-----|---|---|---|
|      |      | JAN   | FEB  | MAR  | APR | MAY | JUN  | JUL | AUG | SEP | OCT | NOV | DEC |   |   |   |
| 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 minimum and 3k pieces maximum per 180mm reel.
2. Complete CTS part number, frequency value and date code information must appear on reel and carton labels.



## Addendum

### Common Frequencies Available – MHz

| FREQUENCY | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE | FREQUENCY  | FREQUENCY CODE | FREQUENCY | FREQUENCY CODE |
|-----------|----------------|-----------|----------------|------------|----------------|-----------|----------------|
| 4.000000  | 040            | 24.000000 | 240            | 40.000000  | 400            |           |                |
| 8.000000  | 080            | 24.576000 | 24C            | 48.000000  | 480            |           |                |
| 10.000000 | 100            | 25.000000 | 250            | 50.000000  | 500            |           |                |
| 12.000000 | 120            | 26.000000 | 260            | 100.000000 | 1000           |           |                |
| 12.288000 | 122            | 27.000000 | 270            | 125.000000 | 1250           |           |                |
| 14.318180 | 143            | 30.000000 | 300            | 156.250000 | 1562           |           |                |
| 14.745600 | 147            | 32.000000 | 320            |            |                |           |                |
| 16.000000 | 160            | 33.333000 | 33E            |            |                |           |                |
| 20.000000 | 200            | 37.400000 | 374            |            |                |           |                |
| 22.118400 | 221            | 38.400000 | 384            |            |                |           |                |