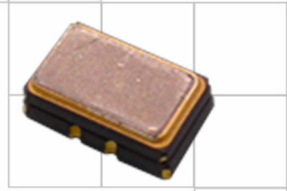


Model 581

Stratum 3 HCMOS TCXO/VC-TCXO



Part Dimensions:
5.0 × 3.2 × 1.65mm • 83mg

Features

- Ceramic Surface Mount Package
- Fundamental Crystal Design
- Frequency Range 10 – 52MHz *
- Operating Voltage +2.5V, +3.0V and +3.3V
- Frequency Stability, Overall ±4.6ppm
- Operating Temperature Range to -40°C to +85°C
- Voltage Control Option for Frequency Tuning [VC-TCXO]
- Enable Function Option
- Tape and Reel Packaging, EIA-481

Standard Frequencies – see Page 8 for common frequencies.

* Check with factory for availability of frequencies not listed.

Applications

- Sub 6GHz 5G Small Cell
- IEEE 1588 Timing
- Synchronous Ethernet
- Base Stations, Femtocells
- Mobile Communication
- Wireless Connectivity
- IoT and IIoT
- GPS
- Test and Measurement

Description

CTS Model 581 is a high performance Temperature Compensated Crystal Oscillator [TCXO] suitable for applications requiring Stratum 3 performance. Employing analog IC technology with HCMOS output and high order temperature compensation engine; coupled with a fundamental quartz crystal M581 has excellent stability and low jitter/phase noise performance.

Ordering Information

| Model | Supply Voltage | Frequency Code [MHz] | Frequency Stability ² | Temperature Range | Frequency Tuning | Packaging | | | | |
|-------|----------------|----------------------|----------------------------------|-------------------------------------|------------------|---------------------------|------|----------------|------|--------------|
| 581 | E | L | XXX | X2 | C | T | | | | |
| | Code | Function | Code | Frequency | Code | Temp. Range | Code | Temp. Range | Code | Packing |
| | Blank | No Enable | | Product Frequency Code ¹ | W | 0°C to +50°C | D | -30°C to +85°C | T | 1k pcs./reel |
| | E | Enable | | | H | -10°C to +60°C | I | -40°C to +85°C | | |
| | | | | | C | -20°C to +70°C | | | | |
| | Code | Voltage | Code | Stability | Code | Frequency Deviation | | | | |
| | N | +2.5Vdc | X5 | ±0.05ppm ³ | T | TCXO [No Voltage Control] | | | | |
| | R | +3.0Vdc | 01 | ±0.10ppm ⁴ | A | ±5ppm - ±15ppm [VC-TCXO] | | | | |
| | L | +3.3Vdc | 02 | ±0.20ppm | | | | | | |
| | | | X2 | ±0.28ppm | | | | | | |
| | | | 05 | ±0.50ppm | | | | | | |

Notes:

1] Refer to document 016-1454-0, Frequency Code Tables. 3-digits for frequencies <100MHz.

2] Frequency vs. Temperature only.

3] Available with operating temperature range code "W".

4] Available with operating temperature range code "W" and "H".

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} | - | -0.6 | - | 4.6 | V |
| Maximum Control Voltage | V _C | - | -0.5 | - | V _{CC} | V |
| Supply Voltage | V _{CC} | ±5% | 2.36 | 2.5 | 2.63 | V |
| | | | 2.85 | 3.0 | 3.15 | |
| | | | 3.14 | 3.3 | 3.47 | |
| Supply Current | I _{CC} | Typical Measured @ 26MHz | - | 4.5 | 9.5 | mA |
| Output Load | C _L | - | - | - | 15 | pF |
| Operating Temperature | T _A | - | 0 | +25 | +50 | °C |
| | | | -10 | | +60 | |
| | | | -20 | | +70 | |
| | | | -30 | | +85 | |
| | | | -40 | | +85 | |
| Storage Temperature | T _{STG} | - | -40 | - | +85 | °C |

Frequency Stability

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------------------|--------------------|--------------------------------------------------------------|-------|---------|------|------|
| Frequency Range | f ₀ | - | | 10 - 52 | | MHz |
| Frequency Stability | | | | | | |
| Overall Frequency Stability | Δf/f ₀ | Reference to f ₀ , Including 20 Years Aging | -4.6 | - | 4.6 | ppm |
| Initial Calibration | | Calibration @ +25°C, At Time of Shipment | -0.8 | - | 0.8 | ppm |
| Temperature Only ¹ | Δf/f ₂₅ | [Fmax - Fmin]/2, Over -40°C to +85°C | -0.28 | - | 0.28 | ppm |
| Voltage Coefficient | Δf/f ₂₅ | Supply Voltage, ±5% | -0.16 | - | 0.16 | ppm |
| Load Coefficient | | Load, ±10% | -0.30 | - | 0.30 | ppm |
| Aging | Δf/f ₂₅ | 20 Years @ +40°C, Nominal V _{CC} and V _C | -3.0 | - | 3.0 | ppm |
| Holdover | Δf/f ₀ | [Fmax - Fmin]/2, Over 24 Hours | -0.4 | - | 0.4 | ppm |

1.] See Ordering Information for additional stability options.

Output Parameters

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|-------------------------|---------------------------------|----------------------------------|---------------------|-------|---------------------|------|
| Output Type | - | - | | HCMOS | | - |
| Output Voltage Levels | V _{OH} | Logic '1' Level, CMOS Load | 0.9*V _{CC} | - | - | V |
| | V _{OL} | Logic '0' Level, CMOS Load | - | - | 0.1*V _{CC} | V |
| Output Duty Cycle | SYM | @ 50% Level | 45 | - | 55 | % |
| Rise and Fall Time | T _R , T _F | @ 20%/80% Levels | - | 3 | 6 | ns |
| Start Up Time | T _S | - | - | 5 | 10 | ms |
| Enable Function Standby | | | | | | |
| Enable Input Voltage | V _{IH} | Pin 6 Logic '1', Output Enabled | 0.7V _{CC} | - | - | V |
| Disable Input Voltage | V _{IL} | Pin 6 Logic '0', Output Disabled | - | - | 0.3V _{CC} | V |
| Enable Current | I _{STB} | Pin 6 Logic '0', Output Disabled | - | - | 10 | μA |
| Enable Time | T _{PLZ} | Pin 6 Logic '1' | - | - | 10 | ms |
| Phase Noise | - | See Typical Plots | - | - | - | - |

Electrical Specifications

Control Voltage

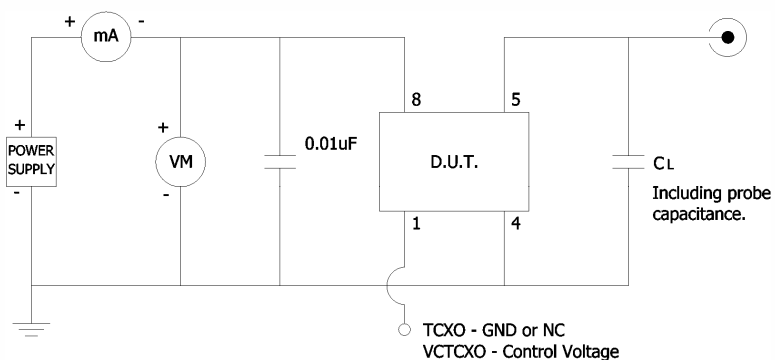
| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP | MAX | UNIT |
|--------------------------------|----------------|------------------------|---------|----------|----------|-------|
| Control Voltage | V_c | Nominal V_{CC} | 0.5 | 1.5 | 2.5 | V |
| Frequency Tuning [VCTCXO Only] | $\Delta f/f_0$ | Specified V_c Range | ± 5 | - | ± 15 | ppm |
| Linearity | L | Best Straight Line Fit | - | - | ± 10 | % |
| Input Impedance | Z_{Vc} | - | 100 | - | - | kOhms |
| Transfer Function | - | - | - | Positive | - | - |

Enable Truth Table

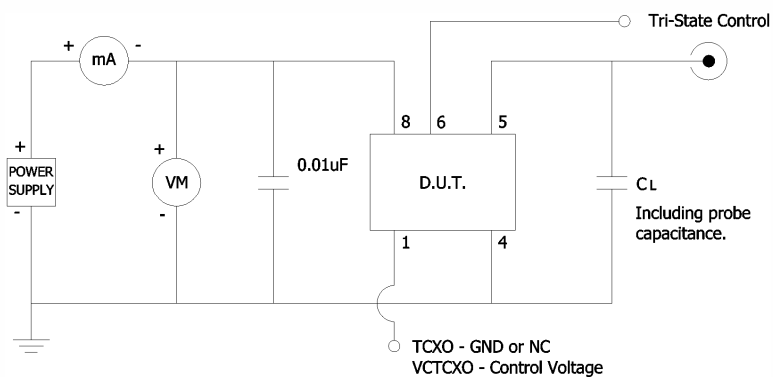
| Pin 6 | Pin 5 |
|-----------|------------------------------------|
| Logic '1' | Output Enabled |
| Open | Output Enabled |
| Logic '0' | Output Disabled, High Impedance |

Test Circuit

HCMOS – w/o Enable Function



HCMOS – w/ Enable Function

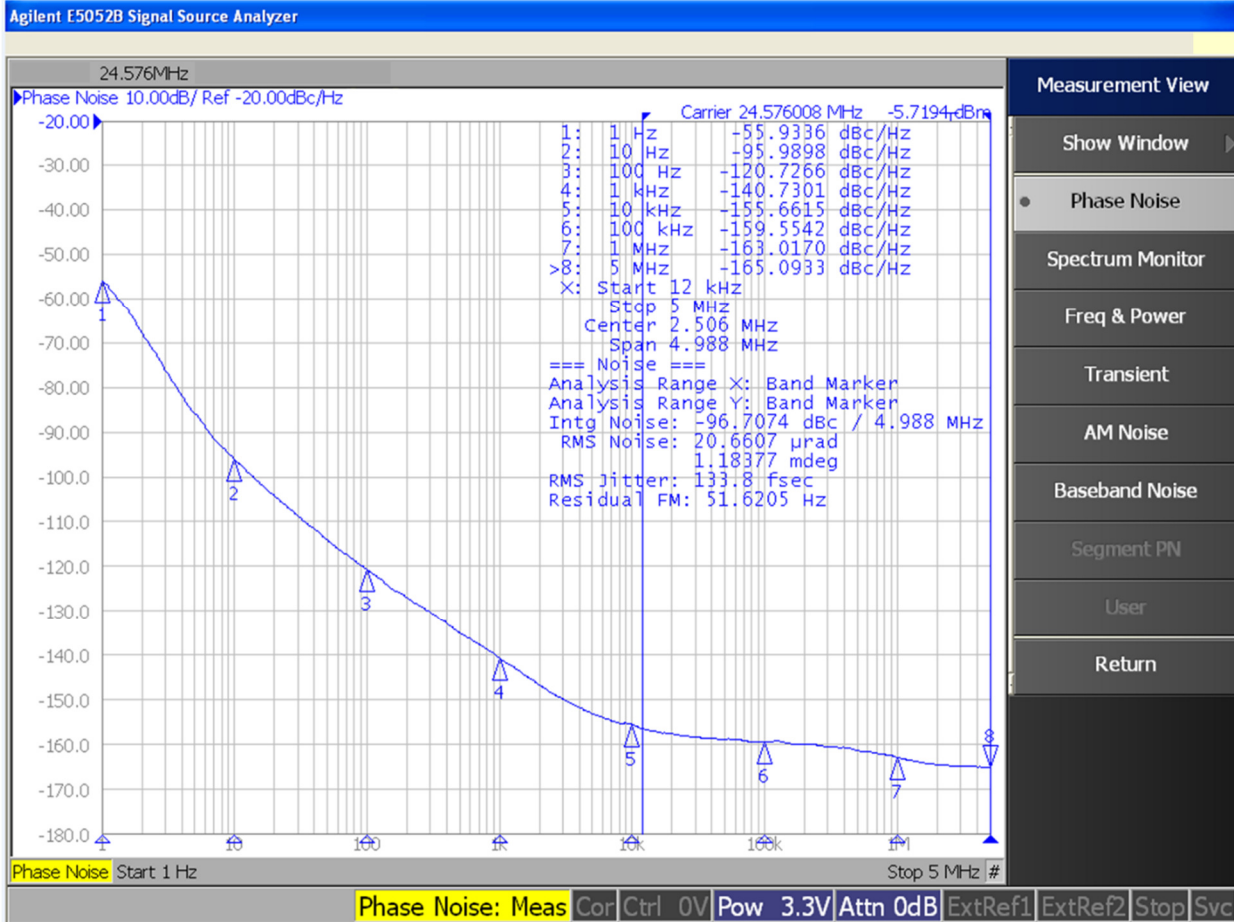


Electrical Specifications

Performance Data

Phase Noise [typical]

24.5760MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$

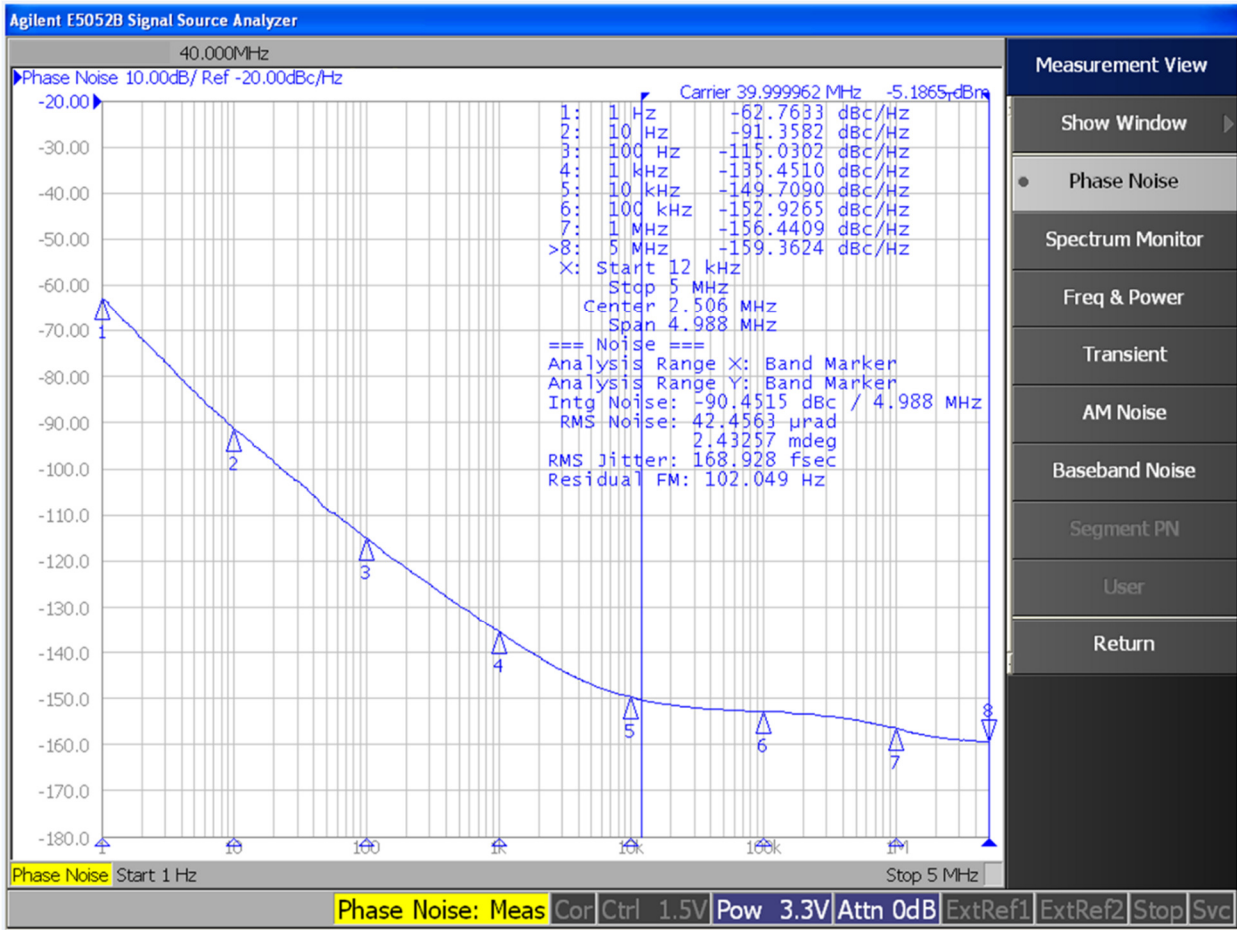


Electrical Specifications

Performance Data

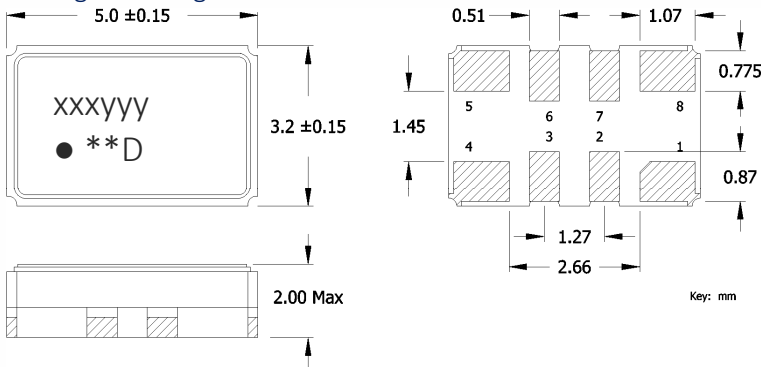
Phase Noise [typical]

40MHz, $V_{CC} = +3.3V$, $T_A = +25^\circ C$



Mechanical Specifications

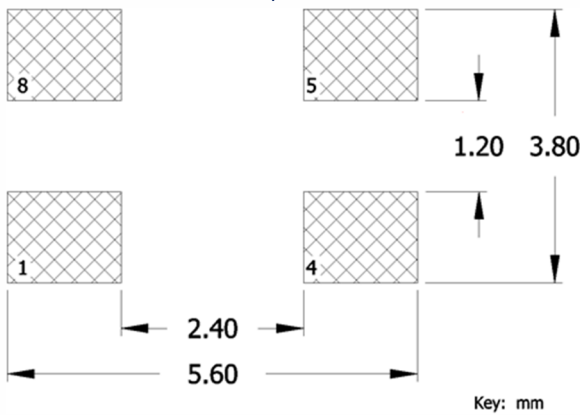
Package Drawing – 8-Pad



Marking Information

- xxx – Frequency Code.
3-digits for frequencies <100MHz
[See document 016-1454-0, Frequency Code Tables.]
- yyy – Crystal Lot Code or Date Code [optional].
- – Pin 1 identifier.
- ** – Manufacturing Site Code.
- D – Date Code. See Table I for codes.

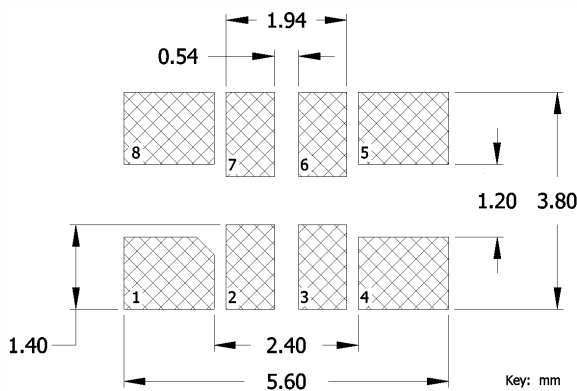
Recommended Pad Layout – w/o Enable Function



Notes

- DO NOT make connections to non-labeled pins or castellations as they may have internal connections used in the manufacturing process.
- JEDEC termination code (e4). Barrier-plating is nickel [Ni] with gold [Au] flash plate.
- Reflow conditions per JEDEC J-STD-020; +260°C maximum, 20 seconds.
- MSL = 1.

Recommended Pad Layout – w/ Enable Function





Mechanical Specifications

Pin Assignments – 8-Pad Solder Attach

| Pin | Symbol | Function |
|-----|-----------------|-------------------------------------------------------|
| 1 | V _C | GND or NC – TCXO [Note 1] Control Voltage – VCTCXO |
| 2 | NC | No Connect |
| 3 | NC | No Connect |
| 4 | GND | Circuit & Package Ground |
| 5 | Output | RF Output |
| 6 | NC or EOH | No Connect or Optional Enable |
| 7 | NC | No Connect |
| 8 | V _{CC} | Supply Voltage |

Pin Assignments – 4-Pad Solder Attach

| Pin | Symbol | Function |
|-----|-----------------|-------------------------------------------------------|
| 1 | V _C | GND or NC – TCXO [Note 1] Control Voltage – VCTCXO |
| 2 | GND | Circuit & Package Ground |
| 3 | Output | RF Output |
| 4 | V _{CC} | Supply Voltage |

Notes

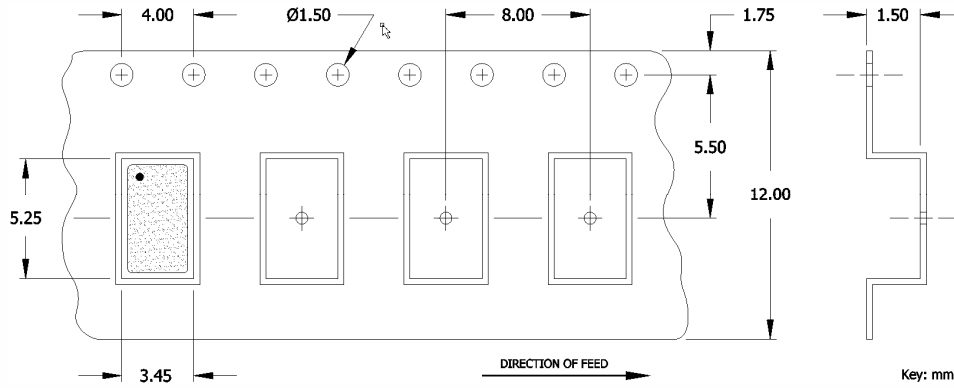
1. Connect to ground for TCXO, no frequency tuning. Pin can be left floating.

Table I - Date Code, Beginning year 2021

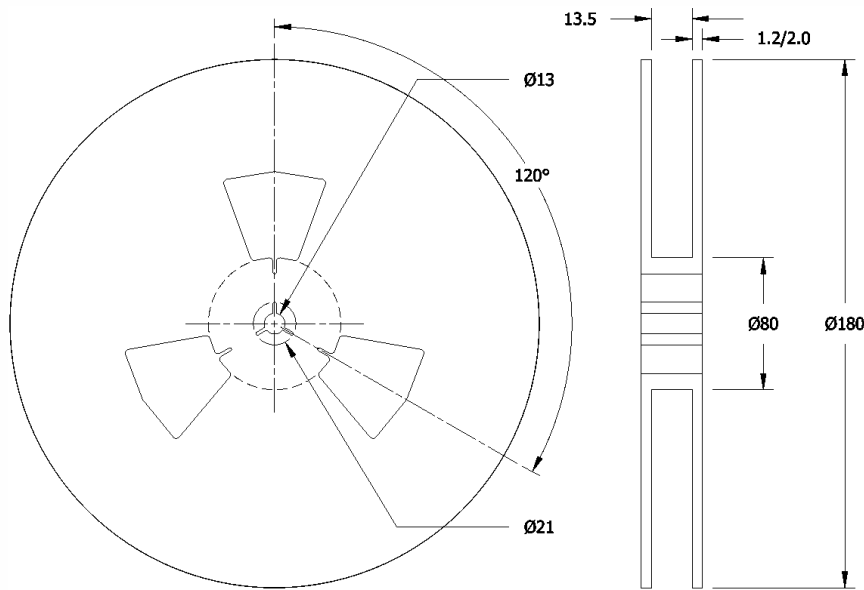
| | | | | | MONTH | | | | | | | | | | | |
|------|------|------|------|------|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| | | | | | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
| YEAR | | | | | | | | | | | | | | | | |
| 2021 | 2025 | 2029 | 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



Reel Drawing



Notes

1. Device quantity is 1k pieces per 180mm reel.
2. Complete CTS part number, frequency value and date code information must appear on reel and carton labels.



Addendum

Common Frequencies and Frequency Codes – MHz

| FREQUENCY | ORDERING CODE | FREQUENCY | ORDERING CODE | FREQUENCY | ORDERING CODE |
|------------------|---------------|------------------|---------------|------------------|---------------|
| 10.000000 | 100 | 25.000000 | 250 | 50.000000 | 500 |
| 12.800000 | 128 | 26.000000 | 260 | 52.000000 | 520 |
| 13.000000 | 130 | 27.000000 | 270 | | |
| 16.000000 | 160 | 30.000000 | 300 | | |
| 16.384000 | 163 | 30.720000 | 307 | | |
| 16.800000 | 168 | 32.000000 | 320 | | |
| 19.200000 | 192 | 36.000000 | 360 | | |
| 19.440000 | 194 | 38.400000 | 384 | | |
| 20.000000 | 200 | 38.880000 | 388 | | |
| 20.480000 | 204 | 40.000000 | 400 | | |
| 24.000000 | 240 | 48.000000 | 480 | | |
| 24.576000 | 24C | 49.152000 | 491 | | |

Frequencies in **bold** are standard.