



**FEATURES**

- **Clipped Sine Wave Output**
- **Optional Voltage Control for Frequency Tuning [VCTCXO]**
- 2.5mmx2.0mm Surface Mount Package
- Frequency Range 10 – 52 MHz [Standard Frequencies List Shown Below]
- Fundamental Crystal Design
- Frequency Stability, several options to choose from  $\pm 0.5\text{ppm} \sim \pm 2.5\text{ppm}$
- Operating Voltage, +1.8Vdc  $\sim$  +2.5Vdc
- Operating Temperature to -40°C to +85°C
- Tape & Reel Packaging Available
- **RoHS/Green Compliant (6/6)**



**APPLICATIONS**

The Model 520 Temperature Compensated Crystal Oscillator (TCXO) is a quartz based, clipped sine wave output, with optional frequency tuning, in a hermetically sealed ceramic package. M520 is suitable for wireless communications, broadband access, WLAN/WiMax/WIFI, portable equipment, test and measurement and mobile applications.

**ORDERING INFORMATION**



\* Frequency vs. Temperature Only

- 1] Only available with temperature range codes "H" and "C".
- 2] Only available with temperature range codes "H", "C" and "D".
- 3] Frequency is recorded with two leading digits before the 'M' and 4 significant digits after the 'M' (including zeros).  
[Ex. XXMXXXX (10M0000), XXMXXXX (16M3840)]
- 4] See Electrical Characteristics for Control Voltage range per Supply Voltage selected.

**Not all performance combinations and frequencies may be available.**  
**Contact your local CTS Representative or CTS Customer Service for availability.**

| M520 Standard Frequencies |           |           |           |           |
|---------------------------|-----------|-----------|-----------|-----------|
| 13.000000                 | 16.368000 | 19.200000 | 26.000000 | 40.000000 |
| 16.367667                 | 16.369000 | 20.000000 | 38.400000 |           |

**ELECTRICAL CHARACTERISTICS**

| PARAMETER                                   | SYMBOL                           | CONDITIONS   | MIN                       | TYP        | MAX             | UNIT   |
|---|----------------------------------|--|---------------------------|------------|-----------------|--------|
| Maximum Supply Voltage                      | V <sub>CC</sub>                  | -  | -0.5                      | -          | 6.0             | V      |
| Maximum Control Voltage                     | V <sub>C</sub>                   | -  | -0.5                      | -          | V <sub>CC</sub> | V      |
| Storage Temperature                         | T <sub>STG</sub>                 | -  | -40                       | -          | 85              | °C     |
| Frequency Range                             | f <sub>0</sub>                   | Std frequencies listed in Ordering Information                       | 10                        | -          | 52              | MHz    |
| Frequency Stability                         | Δf/f <sub>0</sub>                | Frequency vs. Temperature Only                                       | 0.5, 1.0, 1.5<br>2.0, 2.5 |            |                 | ± ppm  |
| Frequency Stability vs. Initial Calibration | -                                | @25°C  | -                         | -          | 2.0             | ± ppm  |
| vs. Supply Voltage                          |                                  | ±5% change   | -                         | -          | 0.2             |        |
| vs. Load                                    |                                  | ±10% change  | -                         | -          | 0.2             |        |
| vs. Reflow Shift                            |                                  | After 2 reflows  | -                         | -          | 2.0             |        |
| vs. Aging                                   |                                  | 1st year   | -                         | -          | 1.0             |        |
|   |                                  | 10 year  | -                         | -          | 10.0            |        |
| Operating Temperature                       | T <sub>A</sub>                   | -  | 0                         | 25         | 55              | °C     |
| Order Code 'W'                              |                                  |  | -10                       |            | 60              |        |
| Order Code 'H'                              |                                  |  | -20                       |            | 70              |        |
| Order Code 'C'                              |                                  |  | -30                       |            | 85              |        |
| Order Code 'D'                              |                                  |  | -40                       |            | 85              |        |
| Order Code 'I'                              |                                  |  |                           |            |                 |        |
| Supply Voltage                              | V <sub>CC</sub>                  | ±5%  | 1.77                      | 1.8        | 1.83            | V      |
| Order Code 'M'                              |                                  |  | 2.38                      | 2.5        | 2.63            |        |
| Order Code 'N'                              |                                  |  | 2.66                      | 2.8        | 2.94            |        |
| Order Code 'T'                              |                                  |  | 2.85                      | 3.0        | 3.15            |        |
| Order Code 'R'                              |                                  |  | 3.14                      | 3.3        | 3.47            |        |
| Order Code 'L'                              |                                  |  |                           |            |                 |        |
| Supply Current                              | I <sub>CC</sub>                  | 10.00 MHz - 25.99 MHz<br>26.00 MHz - 52.00 MHz                       | -                         | -          | 2<br>2.5        | mA     |
| Control Voltage                             | V <sub>C</sub>                   | 2.5V, 2.8V, 3.0V, 3.3V<br>1.8V                                       | 0.4<br>0.3                | 1.5<br>0.9 | 2.4<br>1.5      | V      |
| Frequency Tuning [VCTCXO Only]              | -                                | Specified V <sub>C</sub> Range                                       | 5.0                       | -          | -               | ± ppm  |
| V <sub>C</sub> Input Impedance              | ZV <sub>C</sub>                  | -  | 500                       | -          | -               | kOhm   |
| Output Waveform                             |                                  | AC coupled Clipped Sinewave  |                           |            |                 |        |
| Output Voltage Levels                       | V <sub>O</sub>                   |  | 0.8                       | -          | -               | Vp-p   |
| Output Load                                 | R <sub>L</sub> // C <sub>L</sub> |  | 10 kOhm // 10 pF          |            |                 |        |
| Start Up Time                               | T <sub>S</sub>                   |  | -                         | -          | 2               | ms     |
| Phase Noise                                 | -                                | Varies based on output frequency. See example plot @ 19.2 MHz below. |                           |            |                 | dBc/Hz |

ELECTRICAL PARAMETERS



**ELECTRICAL CHARACTERISTICS**

**D.U.T. PIN ASSIGNMENTS**

| PIN | SYMBOL          | DESCRIPTION                                     |
|-----|-----------------|---|
| 1   | V <sub>C</sub>  | GND – TCXO [Note 1]<br>Control Voltage – VCTCXO |
| 2   | GND             | Circuit & Package Ground                        |
| 3   | Output          | Clipped Sine Wave Output [Note 2]               |
| 4   | V <sub>CC</sub> | Supply Voltage                                  |

**NOTES**

1. Connect to ground for TCXO (no AFC) option.
2. DC-Cut Capacitor Required.  
Add 1000pF capacitor between TCXO output and input of load.

**TEST CIRCUIT – RL//CL LOAD**



\* DC-Cut Capacitor

**MECHANICAL SPECIFICATIONS**

**PACKAGE DRAWING**



**MARKING INFORMATION**

1. M520 - CTS Model Series.
2. ● – Pin 1 identifier.
3. D – Date code. See Table I for codes.
4. XXX – Frequency code. Reference CTS document 016-1454-01.

Complete CTS part number, frequency value and date code information must appear on reel and carton labels.

**NOTES**

1. DO NOT make connections to non-labeled pins and castellations, as they may have internal connections used in the manufacturing process.
2. Termination pads (e4); barrier plating is nickel (Ni) with gold (Au) flash plate.
3. Reflow conditions per JEDEC J-STD-020, 260°C maximum.

**SUGGESTED SOLDER PAD GEOMETRY**



C<sub>BYPASS</sub> should be ≥ 0.01 uF.

**TABLE I – DATE CODE**

| YEAR \ MONTH |      |      |      |      | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|--------------|------|------|------|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|              |      |      |      |      | A   | B   | C   | D   | E   | F   | G   | H   | J   | K   | L   | M   |
| 2001         | 2005 | 2009 | 2013 | 2017 | N   | P   | Q   | R   | S   | T   | U   | V   | W   | X   | Y   | Z   |
| 2002         | 2006 | 2010 | 2014 | 2018 | a   | b   | c   | d   | e   | f   | g   | h   | j   | k   | l   | m   |
| 2003         | 2007 | 2011 | 2015 | 2019 | n   | p   | q   | r   | s   | t   | u   | v   | w   | x   | y   | z   |
| 2004         | 2008 | 2012 | 2016 | 2020 |     |     |     |     |     |     |     |     |     |     |     |     |

**PACKAGING INFORMATION [Reference]**

Device quantity is 1k pieces minimum and 3k maximum per 180mm reel.



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