# Model 520

## Temperature Compensated Crystal Oscillator

### 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 ±0.5ppm ~ ±2.5ppm
- Operating Voltage, +1.8Vdc ~ +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

520 ☐☐☐☐☐☐☐ M ☐☐☐☐

**SUPPLY VOLTAGE**
- M = +1.8Vdc
- N = +2.5Vdc
- T = +2.8Vdc
- R = +3.0Vdc
- L = +3.3Vdc

**FREQUENCY IN MHz**
- M - indicates MHz and decimal point. [3]
- [See table below for standard frequencies available.]

**FREQUENCY TUNING (AFC)**
- T = TCXO (no AFC)
- A = ± 5 ppm [4]

**FREQUENCY STABILITY ***
- 05 = ± 0.5 ppm [1]
- 10 = ± 1.0 ppm [2]
- 15 = ± 1.5 ppm
- 20 = ± 2.0 ppm
- 25 = ± 2.5 ppm (std)

**OPERATING TEMPERATURE RANGE**
- H = -10°C to +60°C
- C = -20°C to +70°C
- D = -30°C to +85°C (std)
- I = -40°C to +85°C

* 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)]

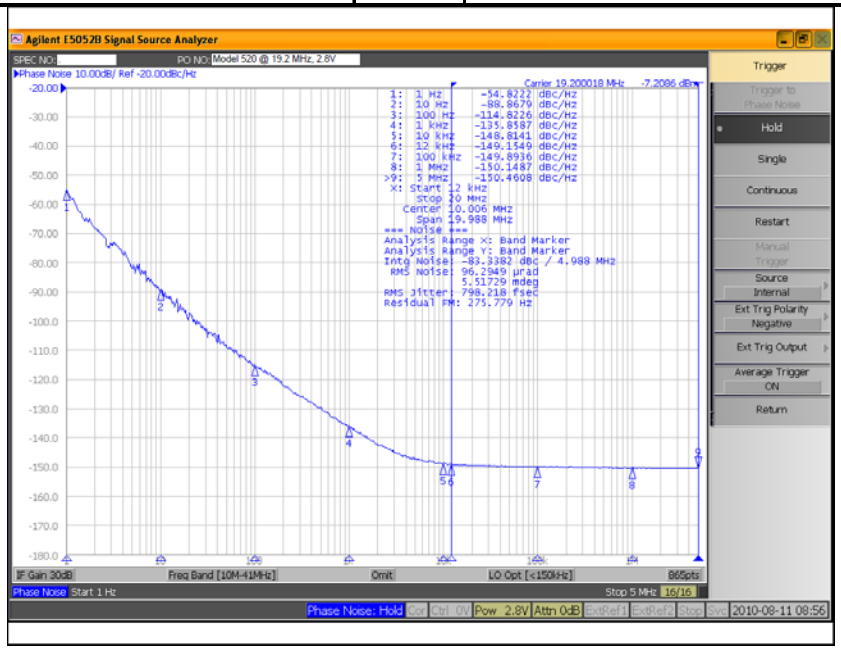
4] See Electrical Characteristics for Control Voltage range per Supply Voltage selected.

**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 |
|---|---|---|---|---|---|---|---|
| ELECTRICAL PARAMETERS | Maximum Supply Voltage | $V_{CC}$ | - | -0.5 | - | 6.0 | V |
| | Maximum Control Voltage | $V_C$ | - | -0.5 | - | $V_{CC}$ | V |
| | Storage Temperature | $T_{STG}$ | - | -40 | - | 85 | °C |
| | Frequency Range | $f_O$ | Std frequencies listed in Ordering Information | 10 | - | 52 | MHz |
| | Frequency Stability | $\Delta f/f_O$ | Frequency vs. Temperature Only | 0.5, 1.0, 1.5<br>2.0, 2.5 | | | ± ppm |
| | Frequency Stability<br>vs. Initial Calibration<br>vs. Supply Voltage<br>vs. Load<br>vs. Reflow Shift<br>vs. Aging | - | <br>@25°C<br>±5% change<br>±10% change<br>After 2 reflows<br>1st year<br>10 year | <br>-<br>-<br>-<br>-<br>-<br>- | <br>-<br>-<br>-<br>-<br>-<br>- | <br>2.0<br>0.2<br>0.2<br>2.0<br>1.0<br>10.0 | ± ppm |
| | Operating Temperature<br>Order Code 'W'<br>Order Code 'H'<br>Order Code 'C'<br>Order Code 'D'<br>Order Code 'I' | $T_A$ | - | <br>0<br>-10<br>-20<br>-30<br>-40 | <br><br><br>25<br><br> | <br>55<br>60<br>70<br>85<br>85 | °C |
| | Supply Voltage<br>Order Code 'M'<br>Order Code 'N'<br>Order Code 'T'<br>Order Code 'R'<br>Order Code 'L' | $V_{CC}$ | ±5% | <br>1.77<br>2.38<br>2.66<br>2.85<br>3.14 | <br>1.8<br>2.5<br>2.8<br>3.0<br>3.3 | <br>1.83<br>2.63<br>2.94<br>3.15<br>3.47 | V |
| | Supply Current | $I_{CC}$ | 10.00 MHz - 25.99 MHz<br>26.00 MHz - 52.00 MHz | -<br>- | -<br>- | 2<br>2.5 | mA |
| | Control Voltage | $V_C$ | 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 $V_C$ Range | 5.0 | - | - | ± ppm |
| | $V_C$ Input Impedance | $ZV_C$ | - | 500 | - | - | kOhm |
| | Output Waveform | | AC coupled Clipped Sinewave | | | | |
| | Output Voltage Levels | $V_O$ | | 0.8 | - | - | Vp-p |
| | Output Load | $R_L$ // $C_L$ | - | 10 kOhm // 10 pF | | | |
| | Start Up Time | $T_S$ | - | - | - | 2 | ms |
| | Phase Noise | - | Varies based on output frequency. See example plot @ 19.2 MHz below. | | | | dBc/Hz |



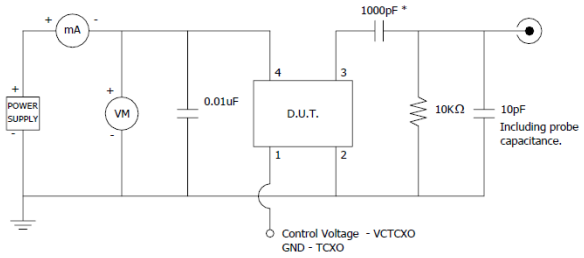
## ELECTRICAL CHARACTERISTICS

### D.U.T. PIN ASSIGNMENTS

| PIN | SYMBOL | DESCRIPTION |
|---|---|---|
| 1 | $V_C$ | GND – TCXO [Note 1]<br>Control Voltage – VCTCXO |
| 2 | GND | Circuit & Package Ground |
| 3 | Output | Clipped Sine Wave Output [Note 2] |
| 4 | $V_{CC}$ | 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.

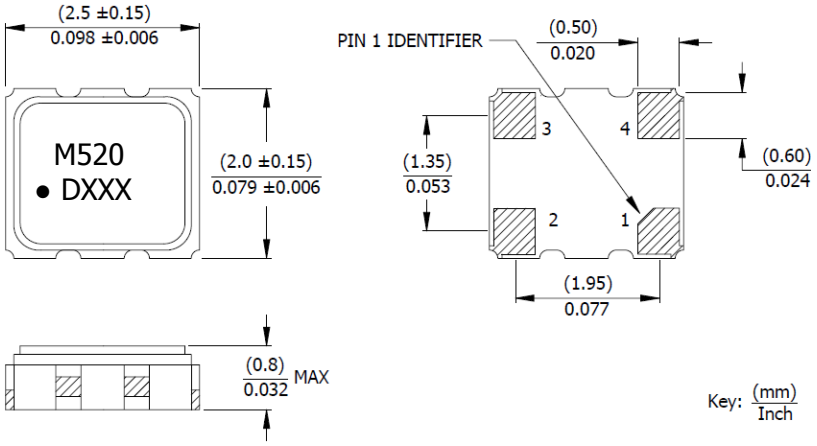
### TEST CIRCUIT – RL//CL LOAD




* DC-Cut Capacitor

## MECHANICAL SPECIFICATIONS

### PACKAGE DRAWING



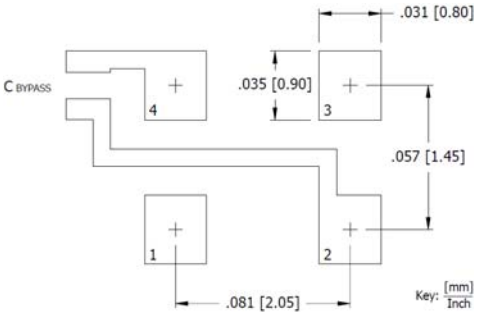

### MARKING INFORMATION

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



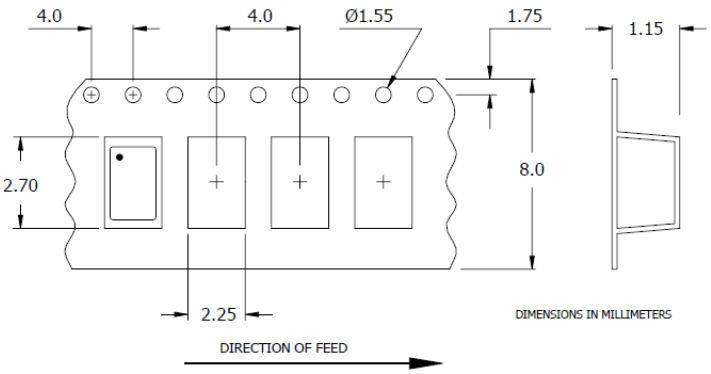

$C_{BYPASS}$ should be ≥ 0.01 uF.

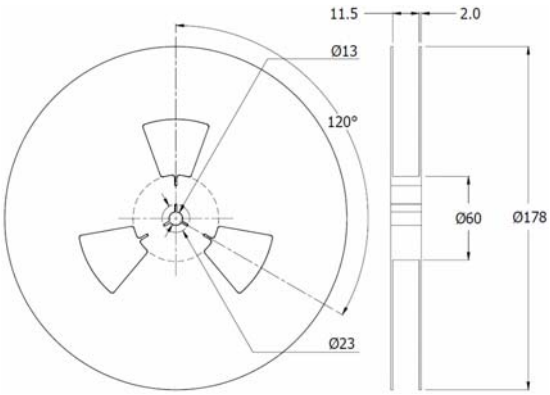
### TABLE I – DATE CODE

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

## PACKAGING INFORMATION [Reference]

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



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