



### FEATURES

- Standard 7.0x5.0mm Surface Mount Footprint
- Stable Frequency Over Temperature and Drive Level
- Frequency Range 8 – 100 MHz
- Frequency Tolerance,  $\pm 30$  ppm Standard ( $\pm 10$  ppm and  $\pm 20$  ppm available)
- Frequency Stability,  $\pm 50$  ppm Standard ( $\pm 10, \pm 20, \pm 30$  and  $\pm 40$  ppm available)
- Operating Temperature to  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- Tape & Reel Packaging, EIA-481-2 Compliant
- **RoHS/Green Compliant**

### DESCRIPTION

The Model 407 is a ceramic packaged Crystal offering reduced size, ideal for high-density circuit board applications. The Model 407 offers reliable precision and excellent shock performance in wireless telecommunication devices.



### ORDERING INFORMATION

407 □ □ □ □ □ □ □ M □ □ □ □

| MODE OF OSCILLATION *        |
|------------------------------|
| F = Fundamental              |
| T = 3 <sup>RD</sup> Overtone |

| FREQUENCY TOLERANCE @ 25°C  |
|-----------------------------|
| 1 = $\pm 10$ ppm            |
| 2 = $\pm 20$ ppm            |
| 3 = $\pm 30$ ppm (standard) |

| STABILITY TOLERANCE/TEMPERATURE RANGE                                       |
|---|
| Over Operating Temperature Range<br>(Referenced to 25°C Reading)            |
| 1 = $\pm 10$ ppm, $-20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$            |
| 2 = $\pm 20$ ppm, $-20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$            |
| 3 = $\pm 30$ ppm, $-20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$            |
| 4 = $\pm 40$ ppm, $-20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$            |
| 5 = $\pm 50$ ppm, $-20^{\circ}\text{C}$ to $+70^{\circ}\text{C}$ (standard) |
| 6 = $\pm 20$ ppm, $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$            |
| 7 = $\pm 30$ ppm, $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$            |
| 8 = $\pm 40$ ppm, $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$            |
| 9 = $\pm 50$ ppm, $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$            |

| FREQUENCY IN MHz   |
|--|
| M - indicates MHz and decimal point.<br>Frequency is recorded with minimum 4 significant digits to the right of the "M". |

| LOAD CAPACITANCE |            |
|------------------|------------|
| A = 10 pF        | G = 30 pF  |
| B = 13 pF        | H = 32 pF  |
| C = 16 pF        | J = 9 pF   |
| D = 18 pF        | K = 8 pF   |
| E = 20 pF        | L = 12 pF  |
| F = 24 pF        | S = Series |

Example Part Numbers:  
407F35A014M3181 ( $F_0 = 14.31818$  MHz)  
407T39A050M0000

Custom performance characteristics are available upon request. Use form C052 to detail non-standard parameters.  
Contact your local CTS Representative or CTS Customer Service for assistance.

\* Prior to 11/7/06 the part number format did not contain this designator. These "Old Format" numbers (008-0261-0 Rev. E) are still valid with frequencies less than or equal to 48.0000 MHz as Fundamental Mode designs. Frequencies above 48.0000 MHz will be Third Overtone designs. Refer to PCM-1211 for more details.

## ELECTRICAL CHARACTERISTICS

|                       | PARAMETER  | VALUE  |
|-----------------------|--|--|
| Electrical Parameters | Operating Mode (Note 1)  | Fundamental or 3 <sup>RD</sup> Overtone                                    |
|                       | Crystal Cut  | AT-Cut   |
|                       | Frequency Range  | 8.0 MHz to 100.0 MHz   |
|                       | Frequency Tolerance @ 25°C   | ± 30 ppm Standard<br>(± 10 ppm and ± 20 ppm Available)                     |
|                       | Frequency Stability Tolerance<br>(Operating Temperature Range, Referenced to 25°C Reading) | ± 50 ppm Standard<br>(± 10 ppm, ± 20 ppm, ± 30 ppm and ± 40 ppm Available) |
|                       | Operating Temperature Range  | -20°C to +70°C Standard<br>(-40°C to +85°C Available)                      |
|                       | Storage Temperature Range  | -55°C to +125°C  |
|                       | Equivalent Series Resistance   | See ESR Table  |
|                       | Load Capacitance or Resonance Mode   | See Ordering Information   |
|                       | Shunt Capacitance (C <sub>0</sub> )  | 4.0 pF Maximum<br>(2.5 pF ± 0.5 pF Typical)                                |
|                       | Drive Level  | 25 μW Typical, 100 μW Maximum  |
|                       | Reflow Condition, per JEDEC J-STD-020  | +255°C ± 5°C, 10 Seconds Maximum   |

## EQUIVALENT SERIES RESISTANCE TABLE

| FREQUENCY RANGE          | MODE of OSCILLATION      | ESR Maximum |
|--------------------------|--------------------------|-------------|
| 8.000 MHz - 15.999 MHz   | Fundamental              | 60 Ohms     |
| 16.000 MHz - 50.000 MHz  | Fundamental              | 40 Ohms     |
| 30.001 MHz - 60.000 MHz  | 3 <sup>RD</sup> Overtone | 100 Ohms    |
| 60.001 MHz - 100.000 MHz | 3 <sup>RD</sup> Overtone | 80 Ohms     |

## MECHANICAL SPECIFICATIONS

### PACKAGE DRAWING



### Notes:

1. Termination pads (e4), barrier-plating is nickel (Ni) with gold (Au) flash plate.
2. Terminations #2, #4 and the metal lid are connected internally. End user may connect these pins to circuit ground.

### MARKING INFORMATION

1. \*\* - Manufacturing Site Code.
2. YWW – Date Code, Y – Last Digit of Year, WW – Week.
3. XXXMXXXX – Frequency marked with 4 significant digits after the 'M'.
4. Complete CTS part number, frequency value and date code information must appear on reel and box labels.

### SUGGESTED SOLDER PAD GEOMETRY



## TAPE AND REEL INFORMATION



Device quantity is 1,000 pieces per 180mm reel.

## ENVIRONMENTAL SPECIFICATIONS

|                                  |   |
|----------------------------------|---|
| Temperature Cycle:               | 400 cycles from $-55^\circ\text{C}$ to $+125^\circ\text{C}$ , 10 minute dwell at each temperature, 1 minute transfer time between temperatures. |
| Mechanical Shock:                | 1,500g's, 0.5mS duration, $\frac{1}{2}$ sinewave, 3 shocks each direction along 3 mutually perpendicular planes (18 total shocks).              |
| Sinusoidal Vibration:            | 0.06 inches double amplitude, 10 to 55 Hz and 20g's, 55 to 2,000 Hz, 3 cycles each in 3 mutually perpendicular planes (9 times total).          |
| Gross Leak:                      | No leak shall appear while immersed in an FC40 or equivalent liquid at $+125^\circ\text{C}$ for 20 seconds.                                     |
| Fine Leak:                       | Mass spectrometer leak rates less than $2 \times 10^{-8}$ ATM cc/sec air equivalent.  |
| Resistance to Solder Heat:       | Product must survive 3 reflows of $+260^\circ\text{C}$ peak, 10 seconds maximum.  |
| High Temperature Operating Bias: | 2,000 hours at $+125^\circ\text{C}$ , disregarding frequency shift.   |
| Frequency Aging:                 | 1,000 hours at $+85^\circ\text{C}$ , maximum $\pm 5$ ppm shift.   |
| Insulation Resistance:           | 500M Ohms @ $100V_{\text{DC}} \pm 15V_{\text{DC}}$ .  |
| Moisture Sensitivity Level:      | Level 1 per JEDEC J-STD-020.  |

## QUALITY AND RELIABILITY

Quality systems meet or exceed the requirements of ISO 9000:2000 standards.