



## 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 (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. 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 (± 10 ppm and ± 20 ppm Available)
	Frequency Stability Tolerance (Operating Temperature Range, Referenced to 25°C Reading)	± 50 ppm Standard (± 10 ppm, ± 20 ppm, ± 30 ppm and ± 40 ppm Available)
	Operating Temperature Range	-20°C to +70°C Standard (-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 (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 @ $100\text{V}_{\text{DC}} \pm 15\text{V}_{\text{DC}}$ .
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.