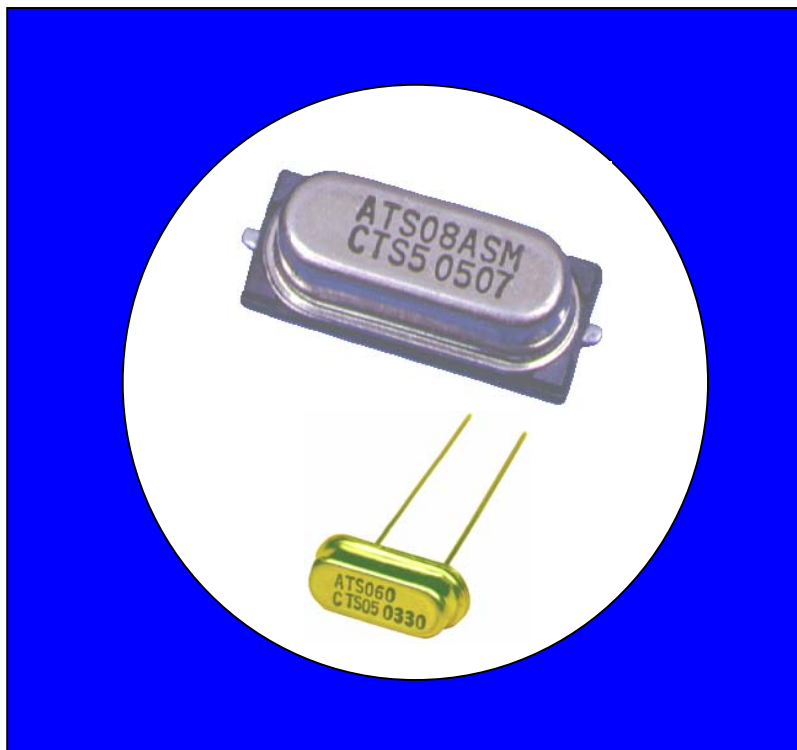


### FEATURES

- Standard HC-49/US or HC-49/US SM Low Profile Package Options
- Stable Frequency Over Temperature and Drive Level
- Fundamental and 3<sup>rd</sup> Overtone Crystals
- Frequency Range 3.5 – 60 MHz
- Frequency Tolerance,  $\pm 30$  ppm Standard
- Frequency Stability,  $\pm 50$  ppm Standard
- Operating Temperature,  $-20^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$
- Tape & Reel Packaging Available
- **RoHS/Green Compliant**

### DESCRIPTION

The ATS/ATS-SM crystal series offers excellent long-term stability and reliability in a proven resistance-weld metal package. The excellent shock performance makes it suitable for microprocessor, telecommunication, consumer electronic and networking applications.



### STANDARD PART NUMBERS AVAILABLE @ CTS DISTRIBUTORS

#### ATS

| PART NUMBER | FREQUENCY (MHz) | LOAD CAPACITANCE | OPERATING MODE |
|-------------|-----------------|------------------|----------------|
| ATS036      | 3.579545        | 18 pF            | Fundamental    |
| ATS037      | 3.686400        | 20 pF            | Fundamental    |
| ATS040      | 4.000000        | 20 pF            | Fundamental    |
| ATS042      | 4.915200        | 20 pF            | Fundamental    |
| ATS050      | 5.068800        | 20 pF            | Fundamental    |
| ATS060      | 6.000000        | 20 pF            | Fundamental    |
| ATS08A      | 8.000000        | 20 pF            | Fundamental    |
| ATS098      | 9.830400        | 20 pF            | Fundamental    |
| ATS100      | 10.000000       | Series           | Fundamental    |
| ATS111      | 11.059200       | 20 pF            | Fundamental    |
| ATS120      | 12.000000       | Series           | Fundamental    |
| ATS122      | 12.288000       | 20 pF            | Fundamental    |
| ATS143      | 14.318180       | Series           | Fundamental    |
| ATS15A      | 15.360000       | 20 pF            | Fundamental    |
| ATS160      | 16.000000       | Series           | Fundamental    |
| ATS16A      | 16.000000       | 20 pF            | Fundamental    |
| ATS200      | 20.000000       | Series           | Fundamental    |
| ATS204      | 20.480000       | 20 pF            | Fundamental    |
| ATS245      | 24.576000       | Series           | Fundamental    |
| ATS250      | 25.000000       | Series           | Fundamental    |
| ATS25A      | 25.000000       | 20 pF            | Fundamental    |

#### ATS-SM

| PART NUMBER | FREQUENCY (MHz) | LOAD CAPACITANCE | OPERATING MODE |
|-------------|-----------------|------------------|----------------|
| ATS036SM    | 3.579545        | 18 pF            | Fundamental    |
| ATS037SM    | 3.686400        | 20 pF            | Fundamental    |
| ATS040SM    | 4.000000        | 20 pF            | Fundamental    |
| ATS042SM    | 4.915200        | 20 pF            | Fundamental    |
| ATS050SM    | 5.068800        | 20 pF            | Fundamental    |
| ATS060SM    | 6.000000        | 20 pF            | Fundamental    |
| ATS08ASM    | 8.000000        | 20 pF            | Fundamental    |
| ATS098SM    | 9.830400        | 20 pF            | Fundamental    |
| ATS100SM    | 10.000000       | Series           | Fundamental    |
| ATS10ASM    | 10.000000       | 20 pF            | Fundamental    |
| ATS111SM    | 11.059200       | 20 pF            | Fundamental    |
| ATS120SM    | 12.000000       | Series           | Fundamental    |
| ATS122SM    | 12.288000       | 20 pF            | Fundamental    |
| ATS143SM    | 14.318180       | Series           | Fundamental    |
| ATS15ASM    | 15.360000       | 20 pF            | Fundamental    |
| ATS160SM    | 16.000000       | Series           | Fundamental    |
| ATS200SM    | 20.000000       | Series           | Fundamental    |
| ATS204SM    | 20.480000       | 20 pF            | Fundamental    |
| ATS245SM    | 24.576000       | Series           | Fundamental    |

Contact your authorized CTS distributor for availability.

## ADDITIONAL PART NUMBERS AVAILABLE FROM CTS

### ATS

| PART NUMBER | FREQUENCY (MHz) | LOAD CAPACITANCE | OPERATING MODE           |
|-------------|-----------------|------------------|--------------------------|
| ATS04A      | 4.000000        | Series           | Fundamental              |
| ATS061      | 6.144000        | 20 pF            | Fundamental              |
| ATS073      | 7.372800        | 20 pF            | Fundamental              |
| ATS080      | 8.000000        | Series           | Fundamental              |
| ATS10A      | 10.000000       | 20 pF            | Fundamental              |
| ATS099      | 9.830400        | Series           | Fundamental              |
| ATS12A      | 12.000000       | 20 pF            | Fundamental              |
| ATS125      | 12.288000       | Series           | Fundamental              |
| ATS123      | 12.296000       | 20 pF            | Fundamental              |
| ATS124      | 12.296000       | Series           | Fundamental              |
| ATS127      | 12.352000       | 20 pF            | Fundamental              |
| ATS126      | 12.352000       | Series           | Fundamental              |
| ATS135      | 13.500000       | 20 pF            | Fundamental              |
| ATS14A      | 14.318180       | 20 pF            | Fundamental              |
| ATS16A      | 16.000000       | 20 pF            | Fundamental              |
| ATS169      | 16.934400       | 20 pF            | Fundamental              |
| ATS184      | 18.432000       | Series           | Fundamental              |
| ATS18A      | 18.432000       | 20 pF            | Fundamental              |
| ATS196      | 19.660800       | Series           | Fundamental              |
| ATS19A      | 19.660800       | 20 pF            | Fundamental              |
| ATS20A      | 20.000000       | 20 pF            | Fundamental              |
| ATS20B      | 20.000000       | 50 pF            | Fundamental              |
| ATS22A      | 22.118400       | 20 pF            | Fundamental              |
| ATS240      | 24.000000       | Series           | Fundamental              |
| ATS24A      | 24.000000       | 20 pF            | Fundamental              |
| ATS24B      | 24.579000       | 20 pF            | Fundamental              |
| ATS320      | 32.000000       | Series           | 3 <sup>RD</sup> Overtone |
| ATS32A      | 32.000000       | 20 pF            | 3 <sup>RD</sup> Overtone |
| ATS400      | 40.000000       | Series           | 3 <sup>RD</sup> Overtone |
| ATS40A      | 40.000000       | 20 pF            | 3 <sup>RD</sup> Overtone |

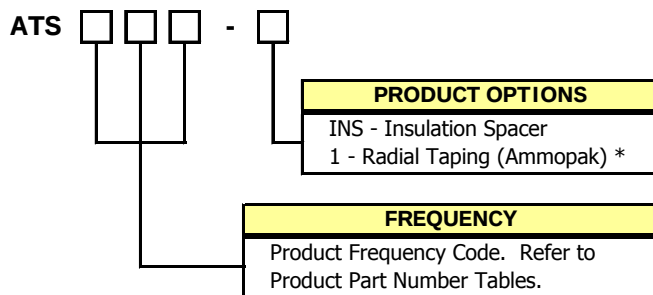
### ATS-SM

| PART NUMBER | FREQUENCY (MHz) | LOAD CAPACITANCE | OPERATING MODE           |
|-------------|-----------------|------------------|--------------------------|
| ATS04ASM    | 4.000000        | Series           | Fundamental              |
| ATS061SM    | 6.144000        | 20 pF            | Fundamental              |
| ATS073SM    | 7.372800        | 20 pF            | Fundamental              |
| ATS080SM    | 8.000000        | Series           | Fundamental              |
| ATS099SM    | 9.830400        | Series           | Fundamental              |
| ATS12ASM    | 12.000000       | 20 pF            | Fundamental              |
| ATS125SM    | 12.288000       | Series           | Fundamental              |
| ATS123SM    | 12.296000       | 20 pF            | Fundamental              |
| ATS124SM    | 12.296000       | Series           | Fundamental              |
| ATS127SM    | 12.352000       | 20 pF            | Fundamental              |
| ATS126SM    | 12.352000       | Series           | Fundamental              |
| ATS135SM    | 13.500000       | 20 pF            | Fundamental              |
| ATS14ASM    | 14.318180       | 20 pF            | Fundamental              |
| ATS16ASM    | 16.000000       | 20 pF            | Fundamental              |
| ATS16BSM    | 16.000000       | 18 pF            | Fundamental              |
| ATS169SM    | 16.934400       | 20 pF            | Fundamental              |
| ATS184SM    | 18.432000       | Series           | Fundamental              |
| ATS18ASM    | 18.432000       | 20 pF            | Fundamental              |
| ATS196SM    | 19.660800       | Series           | Fundamental              |
| ATS19ASM    | 19.660800       | 20 pF            | Fundamental              |
| ATS20ASM    | 20.000000       | 20 pF            | Fundamental              |
| ATS20BSM    | 20.000000       | 50 pF            | Fundamental              |
| ATS22ASM    | 22.118400       | 20 pF            | Fundamental              |
| ATS240SM    | 24.000000       | Series           | Fundamental              |
| ATS24ASM    | 24.000000       | 20 pF            | Fundamental              |
| ATS24BSM    | 24.576000       | 20 pF            | Fundamental              |
| ATS250SM    | 25.000000       | Series           | Fundamental              |
| ATS25ASM    | 25.000000       | 20 pF            | Fundamental              |
| ATS320SM    | 32.000000       | Series           | 3 <sup>RD</sup> Overtone |
| ATS32ASM    | 32.000000       | 20 pF            | 3 <sup>RD</sup> Overtone |
| ATS400SM    | 40.000000       | Series           | 3 <sup>RD</sup> Overtone |
| ATS40ASM    | 40.000000       | 20 pF            | 3 <sup>RD</sup> Overtone |

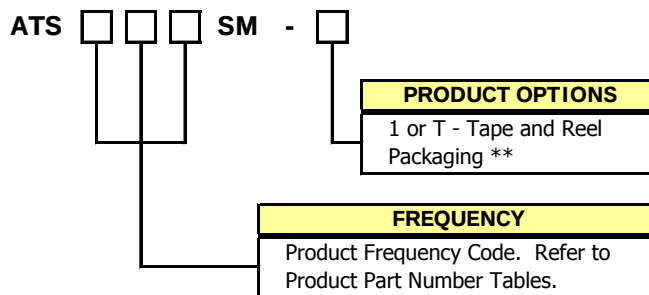
Contact your local CTS Representative or CTS Customer Service for availability.

## ADDITIONAL ORDERING INFORMATION

### Available Standard Product Options



\* Standard packaging is bulk in a bag.



\*\* Standard packaging is tape and reel. CTS Distributors may use -T for Tape and Reel indicator.

### NON-Standard Ordering Options

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

## ELECTRICAL CHARACTERISTICS

|                       | PARAMETER                                                                                  | VALUE                                   |
|-----------------------|--------------------------------------------------------------------------------------------|-----------------------------------------|
| Electrical Parameters | Operating Mode                                                                             | Fundamental or 3 <sup>rd</sup> Overtone |
|                       | Crystal Cut                                                                                | AT-Cut                                  |
|                       | Frequency Range                                                                            | 3.5 MHz to 60.0 MHz                     |
|                       | Frequency Tolerance @ 25°C                                                                 | ± 30 ppm Standard *                     |
|                       | Frequency Stability Tolerance<br>(Operating Temperature Range, Referenced to 25°C Reading) | ± 50 ppm Standard *                     |
|                       | Operating Temperature Range                                                                | -20°C to +70°C *                        |
|                       | Storage Temperature Range                                                                  | -55°C to +125°C                         |
|                       | Equivalent Series Resistance                                                               | See ESR Table                           |
|                       | Load Capacitance or Resonance Mode                                                         | See Standard Part Number Tables *       |
|                       | Shunt Capacitance (C <sub>0</sub> )                                                        | 7.0 pF Maximum                          |
|                       | Drive Level                                                                                | 10 µW Typical, 100 µW Maximum           |
|                       | Reflow Condition, per JEDEC J-STD-020                                                      | +255°C ± 5°C, 10 Seconds Maximum        |

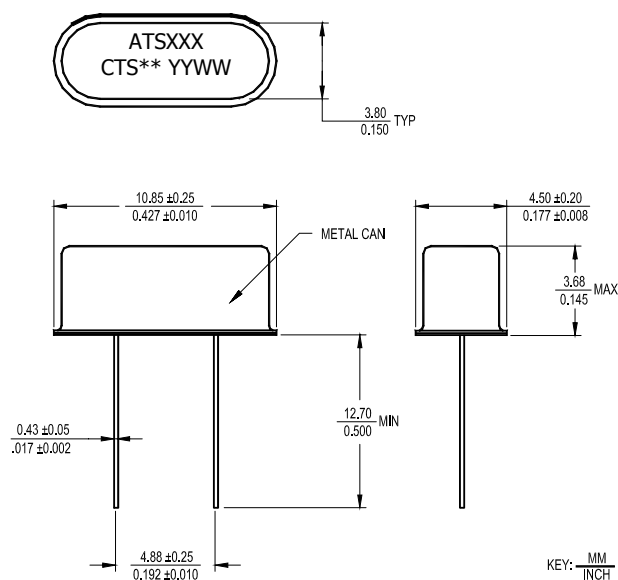
\* Custom requirements are available upon request. Use form C052 to communicate crystal parameters.  
Contact your local CTS Representative or CTS Customer Service for assistance.

## EQUIVALENT SERIES RESISTANCE TABLE

| FREQUENCY RANGE         | MODE of OSCILLATION      | ESR Maximum |
|-------------------------|--------------------------|-------------|
| 3.50 MHz - < 4.00 MHz   | Fundamental              | 150 Ohms    |
| 4.00 MHz - < 5.00 MHz   | Fundamental              | 120 Ohms    |
| 5.00 MHz - < 8.00 MHz   | Fundamental              | 80 Ohms     |
| 8.00 MHz - < 12.00 MHz  | Fundamental              | 60 Ohms     |
| 12.00 MHz - < 20.00 MHz | Fundamental              | 40 Ohms     |
| 20.00 MHz - < 30.00 MHz | Fundamental              | 30 Ohms     |
| 27.00 MHz - 60.00 MHz   | 3 <sup>RD</sup> Overtone | 80 Ohms     |

## MECHANICAL SPECIFICATIONS

### ATS PACKAGE DRAWING



### MARKING INFORMATION

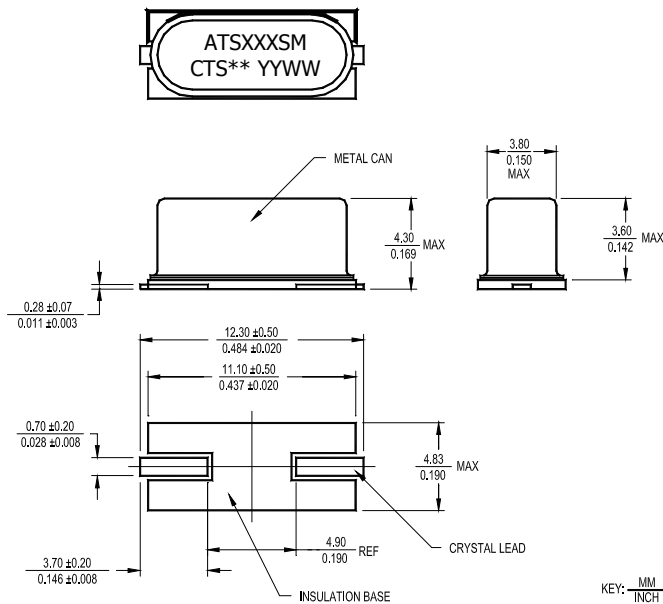
1. CTS Part Number.
2. \*\* - Manufacturing Site Code.
3. YYWW – Date Code, YY – year, WW – week.
4. Complete CTS part number, frequency value and date code information must appear on bag and box labels.

### NOTES

1. Lead finish (e1), SnAgCu.

### MECHANICAL SPECIFICATIONS

#### ATS-SM PACKAGE DRAWING



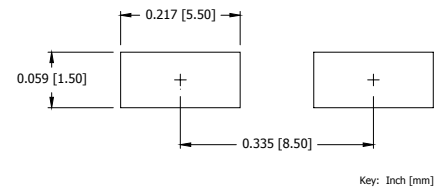
#### MARKING INFORMATION

1. CTS Part Number.
2. \*\* - Manufacturing Site Code.
3. YYWW – Date Code, YY – year, WW – week.
4. Complete CTS part number, frequency value and date code information must appear on reel and box labels.

#### NOTES

1. Lead finish (e1), SnAgCu.

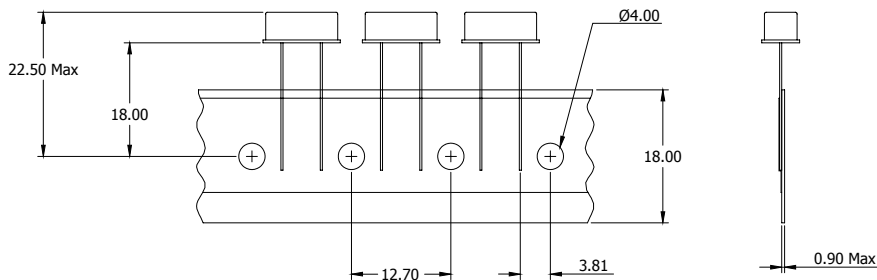
#### SUGGESTED SOLDER PAD GEOMETRY



### PACKAGING INFORMATION

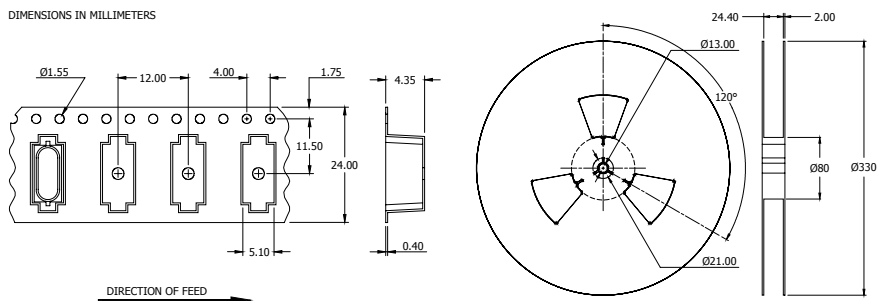
#### ATS Taping (Ammopak)

DIMENSIONS IN MILLIMETERS



#### ATS-SM Tape and Reel

DIMENSIONS IN MILLIMETERS



**ENVIRONMENTAL SPECIFICATIONS**

|                                  |                                                                                                                                        |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Temperature Cycle:               | 400 cycles from -55°C to +125°C, 10 minute dwell at each temperature, 1 minute transfer time between temperatures.                     |
| Mechanical Shock:                | 1,500g's, 0.5mS duration, ½ 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°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°C peak, 10 seconds maximum.                                                                     |
| High Temperature Operating Bias: | 2,000 hours at +125°C, disregarding frequency shift.                                                                                   |
| Frequency Aging:                 | 1,000 hours at +85°C, maximum $\pm 5$ ppm shift.                                                                                       |
| Insulation Resistance:           | 500M Ohms @ 100V <sub>DC</sub> $\pm 15$ V <sub>DC</sub> .                                                                              |
| 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.