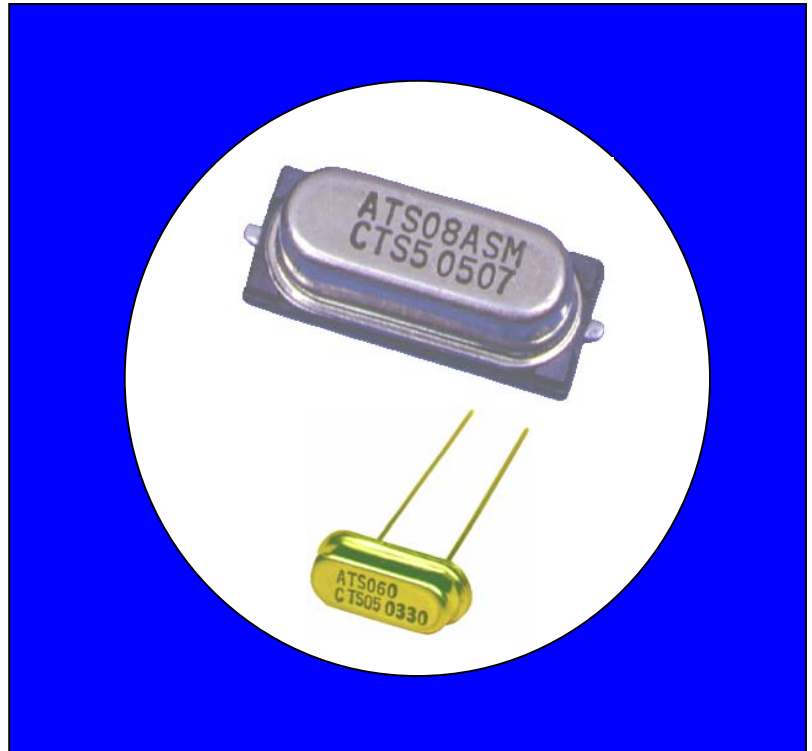


FEATURES

- Standard HC-49/US or HC-49/US SM Low Profile Package Options
- Stable Frequency Over Temperature and Drive Level
- Fundamental and 3rd Overtone Crystals
- Frequency Range 3.5 – 60 MHz
- Frequency Tolerance, ± 30 ppm Standard
- Frequency Stability, ± 50 ppm Standard
- Operating Temperature, -20°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 RD Overtone |
| ATS32A | 32.000000 | 20 pF | 3 RD Overtone |
| ATS400 | 40.000000 | Series | 3 RD Overtone |
| ATS40A | 40.000000 | 20 pF | 3 RD Overtone |

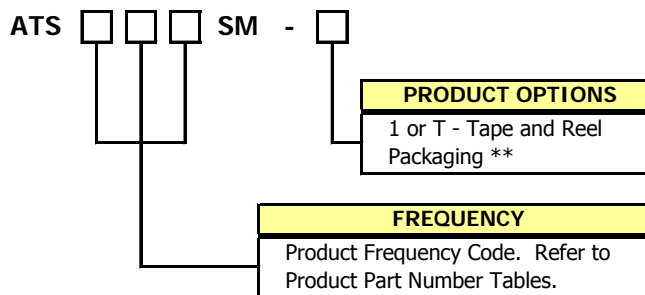
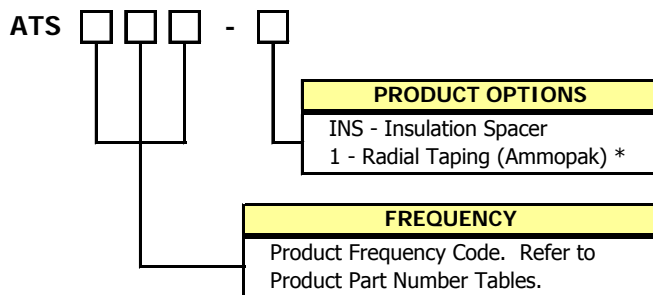
ATS-SM

| 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 RD Overtone |
| ATS32ASM | 32.000000 | 20 pF | 3 RD Overtone |
| ATS400SM | 40.000000 | Series | 3 RD Overtone |
| ATS40ASM | 40.000000 | 20 pF | 3 RD 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 rd Overtone |
| | Crystal Cut | AT-Cut |
| | Frequency Range | 3.5 MHz to 60.0 MHz |
| | Frequency Tolerance @ 25°C | ± 30 ppm Standard * |
| | Frequency Stability Tolerance (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 ₀) | 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 |

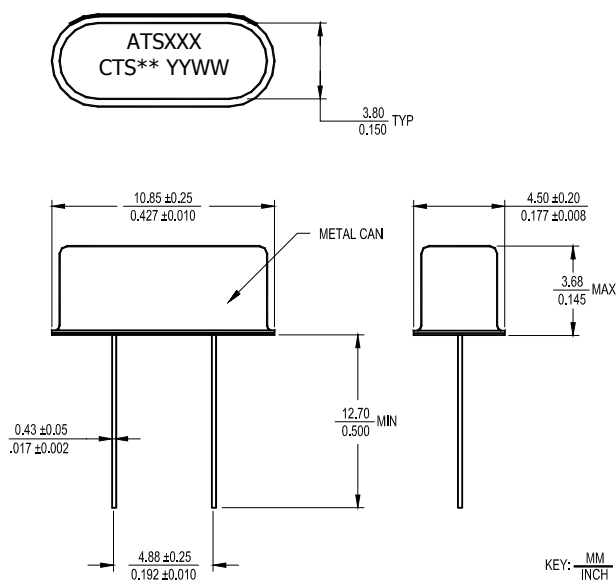
* Custom requirements are available upon request. Use form C052 to communicate crystal parameters. Contact your local CTS Representative or CTS Customer Service for assistance.

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 RD Overtone | 80 Ohms |

MECHANICAL SPECIFICATIONS

ATS PACKAGE DRAWING



MARKING INFORMATION

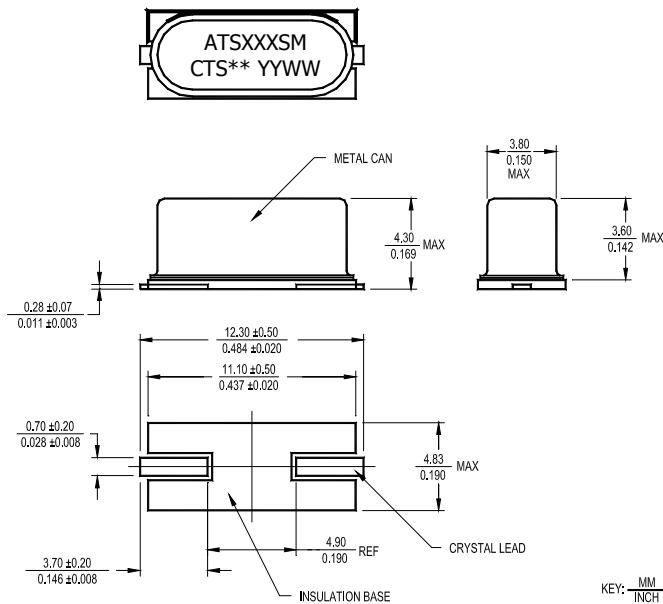
1. CTS Part Number.
2. ** - Manufacturing Site Code.
3. YYWW – Date Code, YY – year, WW – week.
4. Complete CTS part number, frequency value and date code information must appear on bag and box labels.

NOTES

1. Lead finish (e1), SnAgCu.

MECHANICAL SPECIFICATIONS

ATS-SM PACKAGE DRAWING



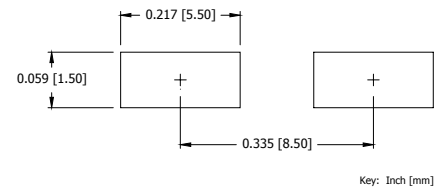
MARKING INFORMATION

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.

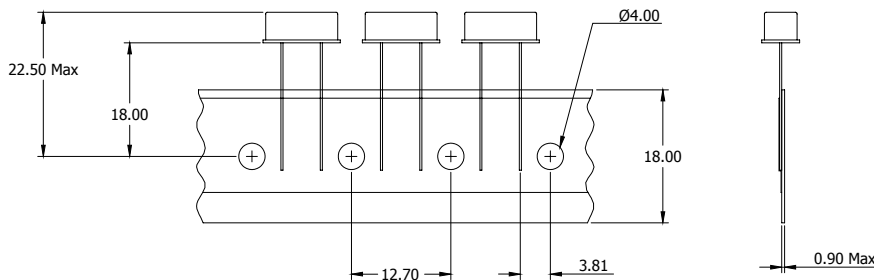
SUGGESTED SOLDER PAD GEOMETRY



PACKAGING INFORMATION

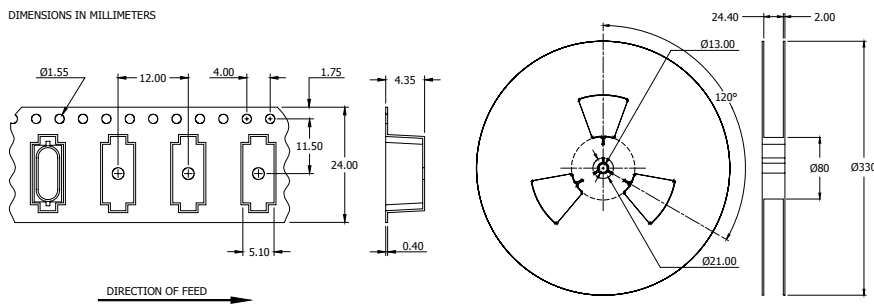
ATS Taping (Ammopak)

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 2×10^{-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 ± 5 ppm shift. |
| Insulation Resistance: | 500M Ohms @ $100V_{DC} \pm 15V_{DC}$. |
| 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.