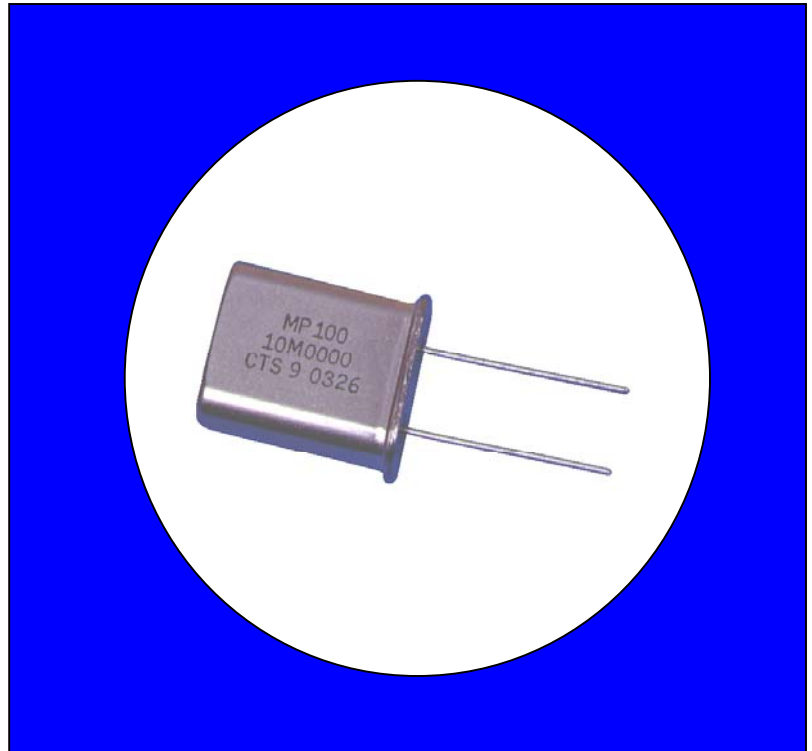


### FEATURES

- Standard HC-49/U Package, HC-49/U SM Package Option Available
- Stable Frequency Over Temperature and Drive Level
- Fundamental and 3<sup>rd</sup> Overtone Crystals
- Frequency Range 1.8 – 48 MHz
- Frequency Tolerance,  $\pm 45$  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 MP 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

| MP          |                 |                  |                |
|-------------|-----------------|------------------|----------------|
| PART NUMBER | FREQUENCY (MHz) | LOAD CAPACITANCE | OPERATING MODE |
| MP018S      | 1.843200        | 13 pF            | Fundamental    |
| MP020S      | 2.000000        | 20 pF            | Fundamental    |
| MP024S      | 2.457600        | 32 pF            | Fundamental    |
| MPS036S     | 3.579545        | 18 pF            | Fundamental    |
| MP037       | 3.686400        | 20 pF            | Fundamental    |
| MP040       | 4.000000        | 20 pF            | Fundamental    |
| MP04A       | 4.000000        | Series           | Fundamental    |
| MP041       | 4.194304        | 12 pF            | Fundamental    |
| MP042       | 4.915200        | 20 pF            | Fundamental    |
| MP05A       | 5.000000        | 20 pF            | Fundamental    |
| MP05B       | 5.000000        | Series           | Fundamental    |
| MP060       | 6.000000        | 20 pF            | Fundamental    |
| MP061       | 6.144000        | 20 pF            | Fundamental    |
| MP073       | 7.372800        | Series           | Fundamental    |
| MP080       | 8.000000        | Series           | Fundamental    |
| MP080A      | 8.000000        | 20 pF            | Fundamental    |
| MP098       | 9.830400        | 20 pF            | Fundamental    |
| MP100       | 10.000000       | Series           | Fundamental    |

| MP          |                 |                  |                |
|-------------|-----------------|------------------|----------------|
| PART NUMBER | FREQUENCY (MHz) | LOAD CAPACITANCE | OPERATING MODE |
| MP101       | 10.000000       | 30 pF            | Fundamental    |
| MP107       | 10.738635       | 32 pF            | Fundamental    |
| MP110       | 11.000000       | 18 pF            | Fundamental    |
| MP111       | 11.059200       | Series           | Fundamental    |
| MP120       | 12.000000       | Series           | Fundamental    |
| MP122       | 12.288000       | 32 pF            | Fundamental    |
| MP143       | 14.318180       | Series           | Fundamental    |
| MP147       | 14.745600       | Series           | Fundamental    |
| MP150       | 15.000000       | Series           | Fundamental    |
| MP160       | 16.000000       | Series           | Fundamental    |
| MP184       | 18.432000       | Series           | Fundamental    |
| MP196       | 19.660800       | Series           | Fundamental    |
| MP200       | 20.000000       | Series           | Fundamental    |
| MP221       | 22.118400       | Series           | Fundamental    |
| MP240       | 24.000000       | Series           | Fundamental    |
| MP245       | 24.576000       | Series           | Fundamental    |
| MP250       | 25.000000       | Series           | Fundamental    |

Contact your authorized CTS Distributor for availability.

## ADDITIONAL PART NUMBERS AVAILABLE FROM CTS

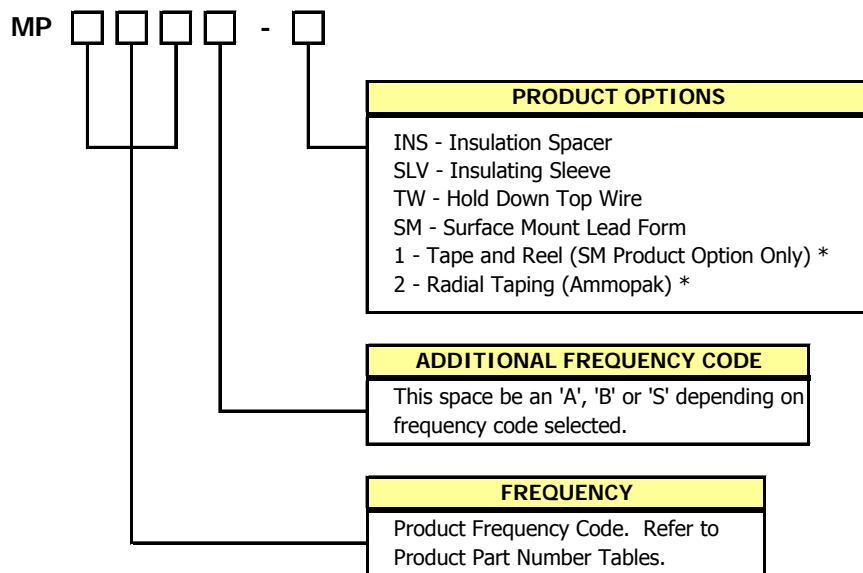
MP

| PART NUMBER | FREQUENCY (MHz) | LOAD CAPACITANCE | OPERATING MODE           |
|-------------|-----------------|------------------|--------------------------|
| MP043       | 4.032000        | 22 pF            | Fundamental              |
| MP050       | 5.068800        | Series           | Fundamental              |
| MP051       | 5.185000        | 20 pF            | Fundamental              |
| MP057       | 5.714300        | Series           | Fundamental              |
| MP057A      | 5.714300        | 20 pF            | Fundamental              |
| MP062       | 6.250000        | 30 pF            | Fundamental              |
| MP064       | 6.400000        | 20 pF            | Fundamental              |
| MP065       | 6.553600        | 20 pF            | Fundamental              |
| MP180       | 18.000000       | Series           | Fundamental              |
| MP270       | 27.000000       | Series           | 3 <sup>RD</sup> Overtone |
| MP360       | 36.000000       | Series           | 3 <sup>RD</sup> Overtone |
| MP400       | 40.000000       | 20 pF            | 3 <sup>RD</sup> Overtone |
| MP480       | 48.000000       | Series           | 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.

### 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  | 1.8 MHz to 48.0 MHz                     |
|                       | Frequency Tolerance @ 25°C   | ± 45 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  | 100 µW Maximum                          |
|                       | Reflow Condition, per JEDEC J-STD-020  | +255°C ± 5°C, 10 Seconds Maximum        |

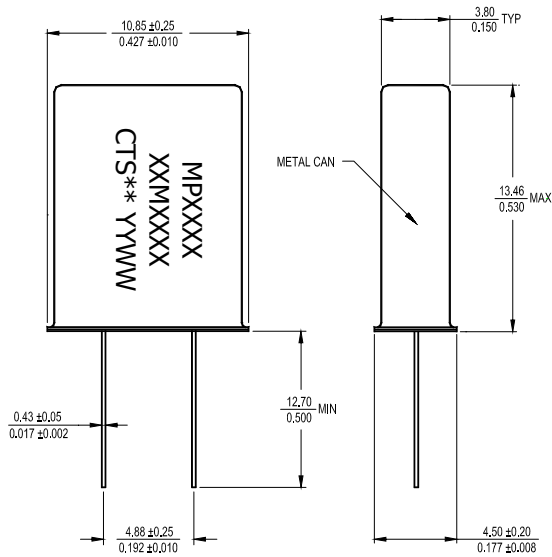
\* Custom requirements are available upon request. Use form C052 to communicate crystal parameters. Contact your local CTS Representative or CTS Customer Service for assistance.

## EQUIVALENT SERIES RESISTANCE TABLE

| FREQUENCY RANGE         | MODE of OSCILLATION      | ESR Maximum |
|-------------------------|--------------------------|-------------|
| 1.80 MHz - < 2.00 MHz   | Fundamental              | 750 Ohms    |
| 2.00 MHz - < 2.40 MHz   | Fundamental              | 550 Ohms    |
| 2.40 MHz - < 3.50 MHz   | Fundamental              | 300 Ohms    |
| 3.50 MHz - < 4.00 MHz   | Fundamental              | 150 Ohms    |
| 4.00 MHz - < 5.00 MHz   | Fundamental              | 75 Ohms     |
| 5.00 MHz - < 6.40 MHz   | Fundamental              | 50 Ohms     |
| 6.40 MHz - < 10.00 MHz  | Fundamental              | 45 Ohms     |
| 10.00 MHz - < 30.00 MHz | Fundamental              | 35 Ohms     |
| 25.00 MHz - < 40.10 MHz | 3 <sup>RD</sup> Overtone | 55 Ohms     |
| 40.10 MHz - 48.00 MHz   | 3 <sup>RD</sup> Overtone | 75 Ohms     |

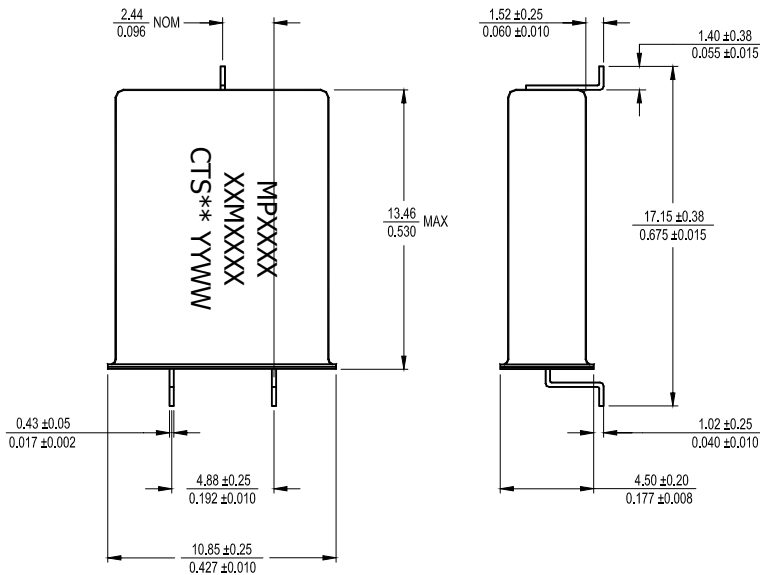
### MECHANICAL SPECIFICATIONS

#### MP PACKAGE DRAWING



KEY:  $\frac{\text{MM}}{\text{INCH}}$

#### MP-SM PACKAGE DRAWING



KEY:  $\frac{\text{MM}}{\text{INCH}}$

#### MARKING INFORMATION

1. CTS Part Number.
2. XXMXXXX – Frequency marked with 4 significant digits after the 'M'.
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.

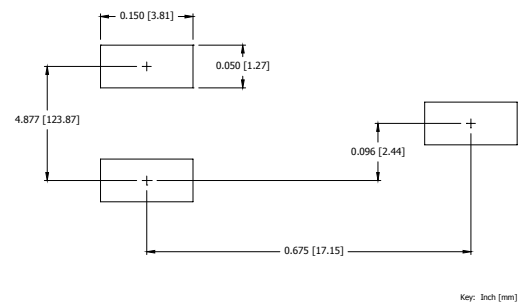
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#### NOTES

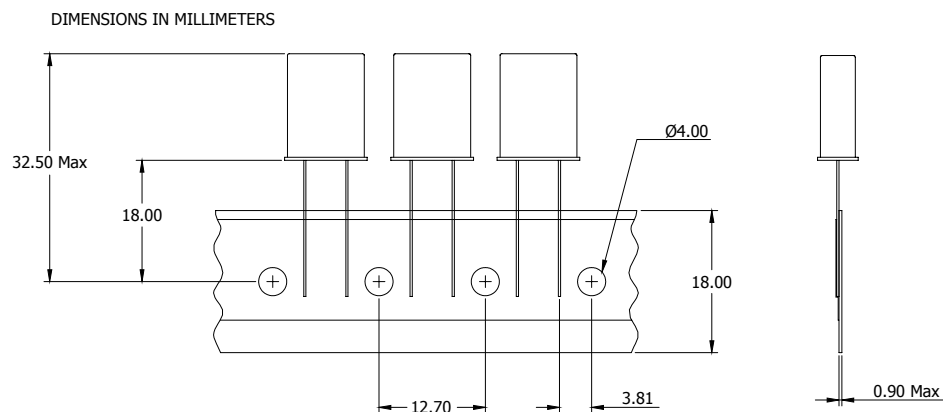
1. Lead finish (e1), SnAgCu.

#### SUGGESTED SOLDER PAD GEOMETRY



## PACKAGING INFORMATION

### MP Taping (Ammopak)



## 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.