



**FEATURES**

- Standard HC-49/U Package, HC-49/U SMMC Package Option Available
- Stable Frequency Over Temperature and Drive Level
- **Fundamental and 3<sup>rd</sup> Overtone Crystals**
- Frequency Range 1.8432 – 64 MHz
- Frequency Tolerance, ±30 ppm Standard
- Frequency Stability, ±50 ppm Standard
- Operating Temperature, -20°C to +70°C Standard, -40°C to +85°C Available
- Tape & Reel Packaging Available
- **RoHS/Green Compliant (6/6)**



**APPLICATIONS**

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, industrial, consumer electronics and networking applications.

**ORDERING INFORMATION**



\*\* Standard packaging is bulk in a bag.

\* Consult factory for Option availability.

**Non-Standard Ordering Options**

- Custom requirements may be available upon request. Use form C052 to detail non-standard parameters. ([http://www.ctscorp.com/components/CTS\\_Crystal\\_Specifying\\_Form.xls](http://www.ctscorp.com/components/CTS_Crystal_Specifying_Form.xls))
- Contact your local CTS Representative or CTS Customer Service for assistance.

**STANDARD PRODUCT PART NUMBERS**

Part numbers in **BOLD** are common stock items through CTS authorized distributors. Non-bold part numbers may be stocked or are available for order.  
Contact your CTS Distributor or local CTS Representative for availability.

FREQUENCY (MHz)	PART NUMBER -20/70°C	PART NUMBER -40/85°C	LOAD CAPACITANCE	OPERATING MODE	FREQUENCY (MHz)	PART NUMBER -20/70°C	PART NUMBER -40/85°C	LOAD CAPACITANCE	OPERATING MODE
1.843200	MP018A	MP018A-E	Series	Fundamental	10.738635	<b>MP107</b>	MP107-E	32 pF	Fundamental
1.843200	MP018B	MP018B-E	18 pF	Fundamental	11.000000	MP110B	MP110B-E	Series	Fundamental
1.843200	<b>MP018S</b>	MP018S-E	13 pF	Fundamental	11.000000	MP110A	MP110A-E	20 pF	Fundamental
2.000000	MP020A	MP020A-E	Series	Fundamental	11.000000	<b>MP110</b>	MP110-E	18 pF	Fundamental
2.000000	<b>MP020S</b>	MP020S-E	20 pF	Fundamental	11.059200	<b>MP111</b>	MP111-E	Series	Fundamental
2.000000	<b>MP020B</b>	<b>MP020B-E</b>	18 pF	Fundamental	11.059200	MP111A	MP111A-E	20 pF	Fundamental
2.457600	<b>MP024S</b>	MP024S-E	32 pF	Fundamental	11.059200	MP111B	MP111B-E	18 pF	Fundamental
3.579545	MP036	MP036-E	Series	Fundamental	11.059200	MP111C	MP111C-E	32 pF	Fundamental
3.579545	<b>MP036S</b>	MP036S-E	18 pF	Fundamental	12.000000	<b>MP120</b>	MP120-E	Series	Fundamental
3.686400	MP037A	MP037A-E	Series	Fundamental	12.000000	MP120A	MP120A-E	20 pF	Fundamental
3.686400	<b>MP037</b>	MP037-E	20 pF	Fundamental	12.000000	MP120B	MP120B-E	18 pF	Fundamental
3.686400	<b>MP037B</b>	<b>MP037B-E</b>	18 pF	Fundamental	12.000000	MP120C	MP120C-E	32 pF	Fundamental
4.000000	<b>MP04A</b>	MP04A-E	Series	Fundamental	12.288000	MP122C	MP122C-E	Series	Fundamental
4.000000	<b>MP04O</b>	MP04O-E	20 pF	Fundamental	12.288000	MP122A	MP122A-E	20 pF	Fundamental
4.000000	<b>MP04OB</b>	<b>MP04OB-E</b>	18 pF	Fundamental	12.288000	MP122B	MP122B-E	18 pF	Fundamental
4.032000	MP043A	MP043A-E	Series	Fundamental	12.288000	<b>MP122</b>	MP122-E	32 pF	Fundamental
4.032000	MP043	MP043-E	20 pF	Fundamental	14.318180	<b>MP143</b>	MP143-E	Series	Fundamental
4.096000	MP042A	MP042A-E	20 pF	Fundamental	14.318180	<b>MP143B</b>	<b>MP143B-E</b>	18 pF	Fundamental
4.194304	<b>MP041</b>	MP041-E	12 pF	Fundamental	14.745600	<b>MP147</b>	MP147-E	Series	Fundamental
4.915200	MP049A	MP049A-E	Series	Fundamental	14.745600	MP147A	MP147A-E	20 pF	Fundamental
4.915200	<b>MP042</b>	MP042-E	20 pF	Fundamental	14.745600	MP147B	MP147B-E	18 pF	Fundamental
4.915200	<b>MP049B</b>	<b>MP049B-E</b>	18 pF	Fundamental	15.000000	<b>MP150</b>	MP150-E	Series	Fundamental
5.000000	<b>MP05B</b>	MP05B-E	Series	Fundamental	16.000000	<b>MP160</b>	MP160-E	Series	Fundamental
5.000000	<b>MP05A</b>	MP05A-E	20 pF	Fundamental	16.000000	MP160A	MP160A-E	20 pF	Fundamental
5.000000	<b>MP050C</b>	<b>MP050C-E</b>	18 pF	Fundamental	16.000000	MP160B	MP160B-E	18 pF	Fundamental
5.068000	<b>MP05O</b>	MP05O-E	Series	Fundamental	18.000000	MP180	MP180-E	Series	Fundamental
5.068000	MP051A	MP051A-E	20 pF	Fundamental	18.432000	<b>MP184</b>	MP184-E	Series	Fundamental
5.185000	MP052	MP052-E	Series	Fundamental	18.432000	MP184A	MP184A-E	20 pF	Fundamental
5.185000	MP051	MP051-E	20 pF	Fundamental	18.432000	MP184B	MP184B-E	18 pF	Fundamental
5.185000	MP052C	MP052C-E	32 pF	Fundamental	19.660800	<b>MP196</b>	MP196-E	Series	Fundamental
5.714300	MP057	MP057-E	Series	Fundamental	19.660800	MP196A	MP196A-E	20 pF	Fundamental
5.714300	MP057A	MP057A-E	20 pF	Fundamental	19.660800	MP196B	MP196B-E	18 pF	Fundamental
6.000000	MP060A	MP060A-E	Series	Fundamental	20.000000	<b>MP200</b>	MP200-E	Series	Fundamental
6.000000	<b>MP06O</b>	MP06O-E	20 pF	Fundamental	20.000000	MP200A	MP200A-E	20 pF	Fundamental
6.000000	<b>MP060B</b>	<b>MP060B-E</b>	18 pF	Fundamental	20.000000	MP200B	MP200B-E	18 pF	Fundamental
6.000000	MP060C	MP060C-E	32 pF	Fundamental	22.118400	<b>MP221</b>	MP221-E	20 pF	Fundamental
6.144000	<b>MP061</b>	MP061-E	20 pF	Fundamental	22.118400	MP221B	MP221B-E	18 pF	Fundamental
6.144000	MP061C	MP061C-E	32 pF	Fundamental	24.000000	<b>MP24O</b>	MP24O-E	Series	Fundamental
6.250000	MP062	MP062-E	30 pF	Fundamental	24.000000	MP240A	MP240A-E	20 pF	Fundamental
6.400000	MP064	MP064-E	20 pF	Fundamental	24.000000	MP240B	MP240B-E	18 pF	Fundamental
6.553600	MP065	MP065-E	20 pF	Fundamental	24.576000	<b>MP245</b>	MP245-E	Series	Fundamental
6.553600	MP065C	MP065C-E	12 pF	Fundamental	24.576000	MP245B	MP245B-E	18 pF	Fundamental
7.372800	<b>MP073</b>	MP073-E	Series	Fundamental	25.000000	<b>MP25O</b>	MP25O-E	Series	Fundamental
7.372800	MP073A	MP073A-E	20 pF	Fundamental	25.000000	MP250A	MP250A-E	20 pF	Fundamental
7.372800	<b>MP073B</b>	MP073B-E	18 pF	Fundamental	25.000000	MP250B	MP250B-E	18 pF	Fundamental
8.000000	<b>MP08O</b>	MP08O-E	Series	Fundamental	27.000000	MP27O	MP27O-E	Series	3rd Overtone
8.000000	<b>MP080A</b>	MP080A-E	20 pF	Fundamental	27.000000	MP270B	MP270B-E	18 pF	3rd Overtone
8.000000	<b>MP080B</b>	<b>MP080B-E</b>	18 pF	Fundamental	32.000000	MP320A	MP320A-E	20 pF	3rd Overtone
8.000000	MP080C	MP080C-E	32 pF	Fundamental	32.000000	MP320B	MP320B-E	18 pF	3rd Overtone
8.192000	MP081B	MP081B-E	18 pF	Fundamental	32.768000	MP327B	MP327B-E	18 pF	3rd Overtone
9.216000	MP092B	MP092B-E	18 pF	Fundamental	36.000000	MP36O	MP36O-E	Series	3rd Overtone
9.830400	MP098A	MP098A-E	Series	Fundamental	40.000000	<b>MP40O</b>	MP40O-E	20 pF	3rd Overtone
9.830400	<b>MP098</b>	MP098-E	20 pF	Fundamental	48.000000	MP48O	MP48O-E	Series	3rd Overtone
9.830400	<b>MP098B</b>	<b>MP098B-E</b>	18 pF	Fundamental	48.000000	MP480A	MP480A-E	20 pF	3rd Overtone
10.000000	<b>MP10O</b>	MP10O-E	Series	Fundamental	48.000000	MP480B	MP480B-E	18 pF	3rd Overtone
10.000000	MP100A	MP100A-E	20 pF	Fundamental	50.000000	<b>MP500B</b>	<b>MP500B-E</b>	18 pF	3rd Overtone
10.000000	MP100B	MP100B-E	18 pF	Fundamental	64.000000	MP640B	MP640B-E	18 pF	3rd Overtone
10.000000	<b>MP101</b>	MP101-E	30 pF	Fundamental					

**ELECTRICAL CHARACTERISTICS**

	PARAMETER	VALUE
<b>ELECTRICAL PARAMETERS</b>	Frequency Range	1.8432 MHz to 64.0 MHz
	Operating Mode	Fundamental or 3rd Overtone
	Crystal Cut	AT-Cut
	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 * -40°C to +85°C Available, See Ordering Information
	Equivalent Series Resistance	See ESR Table
	Load Capacitance or Resonance Mode	See Standard Part Numbers tables *
	Shunt Capacitance (C <sub>0</sub> )	7.0 pF Maximum
	Drive Level	100 µW Typical, 1,000 µW Maximum
	Aging @ +25°C	±3 ppm/yr Typical, ±5 ppm/yr Maximum
	Storage Temperature Range	-40°C to +85°C
	Reflow Condition, per JEDEC J-STD-020	+250°C Maximum, 10 Seconds Maximum

\* Custom requirements may be available upon request. Use form C052 to detail non-standard parameters.

**EQUIVALENT SERIES RESISTANCE TABLE**

FREQUENCY RANGE	OSCILLATION MODE	ESR MAXIMUM
1.80 MHz - < 2.00 MHz	Fundamental	600 Ohms
2.00 MHz - < 2.40 MHz	Fundamental	500 Ohms
2.40 MHz - < 3.00 MHz	Fundamental	300 Ohms
3.00 MHz - < 3.70 MHz	Fundamental	200 Ohms
3.70 MHz - < 4.20 MHz	Fundamental	100 Ohms
4.20 MHz - < 4.90 MHz	Fundamental	70 Ohms
4.90 MHz - < 6.00 MHz	Fundamental	50 Ohms
6.00 MHz - < 8.00 MHz	Fundamental	40 Ohms
8.00 MHz - < 10.00 MHz	Fundamental	35 Ohms
10.00 MHz - < 12.50 MHz	Fundamental	30 Ohms
12.50 MHz - < 40.00 MHz	Fundamental	25 Ohms
24.00 MHz - < 64.00 MHz	3rd Overtone	55 Ohms

**MECHANICAL SPECIFICATIONS**

**MP PACKAGE DRAWING**



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

**MARKING INFORMATION**

1. MPXXXX - CTS Part Number.  
[Per Ordering Information Format]
2. XXMXXXXXX - Frequency is marked with only leading significant digits before the 'M' and 4 - 6 digits after the 'M' (including zeros).  
Ex. XMXXXXXX - 3M579545  
XXMXXXXXX - 14M31818  
XXMXXXXX - 20M0000
3. \*\* - Manufacturing Site Code.
4. 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.

**MP PACKAGE W/ WELDED TOP WIRE (TW) OPTION**



**OBSOLETE**

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

**MECHANICAL SPECIFICATIONS**

**MP-SMMC OPTION W/ METAL CLIP THIRD LEAD**



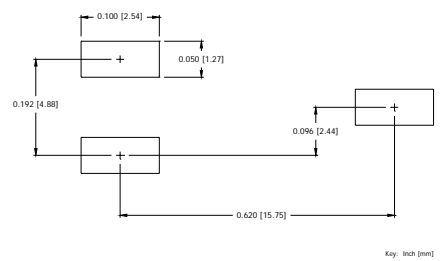
**SUGGESTED SOLDER PAD GEOMETRY**



**MP-SM OPTION W/ WELDED TOP WIRE THIRD LEAD**



**SUGGESTED SOLDER PAD GEOMETRY**



**PACKAGING INFORMATION [Reference Only]**

**MP Radial Taping (Ammopak)**



**MP-SMMC Tape and 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 $+250^{\circ}\text{C}$ maximum, 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.