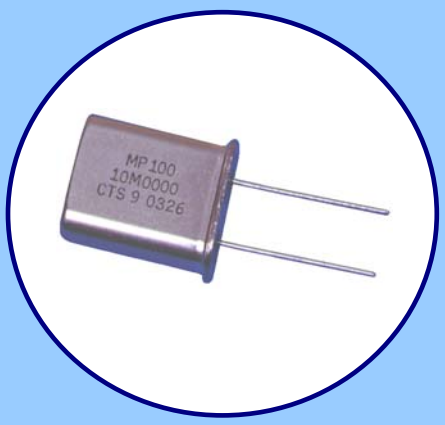
# MP Series
## Quartz Crystal

### FEATURES

- Standard HC-49/U Package, HC-49/U SM Package Option Available
- Stable Frequency Over Temperature and Drive Level
- **Fundamental and 3rd 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

MP □□□□ - □□□

**FREQUENCY/LOAD CODE**

Product Frequency/Load Code.
[3 to 4 digits]

Refer to Standard Product Part Numbers table on Page 2.

**PRODUCT OPTIONS**

INS - Mylar Insulation Spacer
SLV - Insulating Body Sleeve *
TW - Hold Down Top Wire (welded) *
SM - Surface Mount Lead Form w/ TW Third Lead *
SMMC - Surface Mount Lead Form w/ Metal Clip Third Lead *

**PACKAGING OPTIONS**

Blank - Bulk **
1 - Tape and Reel (SM/SMMC Product Option Only)
2 - Radial Taping (Ammopak)

**TEMPERATURE RANGE OPTIONS**

Blank - Standard, -20°C to +70°C
E - Extended Temperature Range, -40°C to +85°C

** **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)
- 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 |
|---|---|---|---|---|
| 1.843200 | MP018A | MP018A-E | Series | Fundamental |
| 1.843200 | MP018B | MP018B-E | 18 pF | Fundamental |
| 1.843200 | **MP018S** | MP018S-E | 13 pF | Fundamental |
| 2.000000 | MP020A | MP020A-E | Series | Fundamental |
| 2.000000 | **MP020S** | MP020S-E | 20 pF | Fundamental |
| 2.000000 | **MP020B** | **MP020B-E** | 18 pF | Fundamental |
| 2.457600 | **MP024S** | MP024S-E | 32 pF | Fundamental |
| 3.579545 | MP036 | MP036-E | Series | Fundamental |
| 3.579545 | **MP036S** | MP036S-E | 18 pF | Fundamental |
| 3.686400 | MP037A | MP037A-E | Series | Fundamental |
| 3.686400 | **MP037** | MP037-E | 20 pF | Fundamental |
| 3.686400 | **MP037B** | **MP037B-E** | 18 pF | Fundamental |
| 4.000000 | **MP04A** | MP04A-E | Series | Fundamental |
| 4.000000 | **MP040** | MP040-E | 20 pF | Fundamental |
| 4.000000 | **MP040B** | **MP040B-E** | 18 pF | Fundamental |
| 4.032000 | MP043A | MP043A-E | Series | Fundamental |
| 4.032000 | MP043 | MP043-E | 20 pF | Fundamental |
| 4.096000 | MP042A | MP042A-E | 20 pF | Fundamental |
| 4.194304 | **MP041** | MP041-E | 12 pF | Fundamental |
| 4.915200 | MP049A | MP049A-E | Series | Fundamental |
| 4.915200 | **MP042** | MP042-E | 20 pF | Fundamental |
| 4.915200 | **MP049B** | **MP049B-E** | 18 pF | Fundamental |
| 5.000000 | **MP05B** | MP05B-E | Series | Fundamental |
| 5.000000 | **MP05A** | MP05A-E | 20 pF | Fundamental |
| 5.000000 | **MP050C** | **MP050C-E** | 18 pF | Fundamental |
| 5.068000 | **MP050** | MP050-E | Series | Fundamental |
| 5.068000 | MP051A | MP051A-E | 20 pF | Fundamental |
| 5.185000 | MP052 | MP052-E | Series | Fundamental |
| 5.185000 | MP051 | MP051-E | 20 pF | Fundamental |
| 5.185000 | MP052C | MP052C-E | 32 pF | Fundamental |
| 5.714300 | MP057 | MP057-E | Series | Fundamental |
| 5.714300 | MP057A | MP057A-E | 20 pF | Fundamental |
| 6.000000 | MP060A | MP060A-E | Series | Fundamental |
| 6.000000 | **MP060** | MP060-E | 20 pF | Fundamental |
| 6.000000 | **MP060B** | **MP060B-E** | 18 pF | Fundamental |
| 6.000000 | MP060C | MP060C-E | 32 pF | Fundamental |
| 6.144000 | **MP061** | MP061-E | 20 pF | Fundamental |
| 6.144000 | MP061C | MP061C-E | 32 pF | Fundamental |
| 6.250000 | MP062 | MP062-E | 30 pF | Fundamental |
| 6.400000 | MP064 | MP064-E | 20 pF | Fundamental |
| 6.553600 | MP065 | MP065-E | 20 pF | Fundamental |
| 6.553600 | MP065C | MP065C-E | 12 pF | Fundamental |
| 7.372800 | **MP073** | MP073-E | Series | Fundamental |
| 7.372800 | MP073A | MP073A-E | 20 pF | Fundamental |
| 7.372800 | MP073B | MP073B-E | 18 pF | Fundamental |
| 8.000000 | **MP080** | MP080-E | Series | Fundamental |
| 8.000000 | **MP080A** | MP080A-E | 20 pF | Fundamental |
| 8.000000 | **MP080B** | **MP080B-E** | 18 pF | Fundamental |
| 8.000000 | MP080C | MP080C-E | 32 pF | Fundamental |
| 8.192000 | MP081B | MP081B-E | 18 pF | Fundamental |
| 9.216000 | MP092B | MP092B-E | 18 pF | Fundamental |
| 9.830400 | MP098A | MP098A-E | Series | Fundamental |
| 9.830400 | **MP098** | MP098-E | 20 pF | Fundamental |
| 9.830400 | **MP098B** | **MP098B-E** | 18 pF | Fundamental |
| 10.000000 | **MP100** | MP100-E | Series | Fundamental |
| 10.000000 | MP100A | MP100A-E | 20 pF | Fundamental |
| 10.000000 | MP100B | MP100B-E | 18 pF | Fundamental |
| 10.000000 | **MP101** | MP101-E | 30 pF | Fundamental |

| FREQUENCY (MHz) | PART NUMBER -20/70°C | PART NUMBER -40/85°C | LOAD CAPACITANCE | OPERATING MODE |
|---|---|---|---|---|
| 10.738635 | **MP107** | MP107-E | 32 pF | Fundamental |
| 11.000000 | MP110B | MP110B-E | Series | Fundamental |
| 11.000000 | MP110A | MP110A-E | 20 pF | Fundamental |
| 11.000000 | **MP110** | MP110-E | 18 pF | Fundamental |
| 11.059200 | **MP111** | MP111-E | Series | Fundamental |
| 11.059200 | MP111A | MP111A-E | 20 pF | Fundamental |
| 11.059200 | MP111B | MP111B-E | 18 pF | Fundamental |
| 11.059200 | MP111C | MP111C-E | 32 pF | Fundamental |
| 12.000000 | **MP120** | MP120-E | Series | Fundamental |
| 12.000000 | MP120A | MP120A-E | 20 pF | Fundamental |
| 12.000000 | MP120B | MP120B-E | 18 pF | Fundamental |
| 12.000000 | MP120C | MP120C-E | 32 pF | Fundamental |
| 12.288000 | MP122C | MP122C-E | Series | Fundamental |
| 12.288000 | MP122A | MP122A-E | 20 pF | Fundamental |
| 12.288000 | MP122B | MP122B-E | 18 pF | Fundamental |
| 12.288000 | **MP122** | MP122-E | 32 pF | Fundamental |
| 14.318180 | **MP143** | MP143-E | Series | Fundamental |
| 14.318180 | **MP143B** | **MP143B-E** | 18 pF | Fundamental |
| 14.745600 | **MP147** | MP147-E | Series | Fundamental |
| 14.745600 | MP147A | MP147A-E | 20 pF | Fundamental |
| 14.745600 | MP147B | MP147B-E | 18 pF | Fundamental |
| 15.000000 | **MP150** | MP150-E | Series | Fundamental |
| 16.000000 | **MP160** | MP160-E | Series | Fundamental |
| 16.000000 | MP160A | MP160A-E | 20 pF | Fundamental |
| 16.000000 | MP160B | MP160B-E | 18 pF | Fundamental |
| 18.000000 | MP180 | MP180-E | Series | Fundamental |
| 18.432000 | **MP184** | MP184-E | Series | Fundamental |
| 18.432000 | MP184A | MP184A-E | 20 pF | Fundamental |
| 18.432000 | MP184B | MP184B-E | 18 pF | Fundamental |
| 19.660800 | **MP196** | MP196-E | Series | Fundamental |
| 19.660800 | MP196A | MP196A-E | 20 pF | Fundamental |
| 19.660800 | MP196B | MP196B-E | 18 pF | Fundamental |
| 20.000000 | **MP200** | MP200-E | Series | Fundamental |
| 20.000000 | MP200A | MP200A-E | 20 pF | Fundamental |
| 20.000000 | MP200B | MP200B-E | 18 pF | Fundamental |
| 22.118400 | **MP221** | MP221-E | 20 pF | Fundamental |
| 22.118400 | MP221B | MP221B-E | 18 pF | Fundamental |
| 24.000000 | **MP240** | MP240-E | Series | Fundamental |
| 24.000000 | MP240A | MP240A-E | 20 pF | Fundamental |
| 24.000000 | MP240B | MP240B-E | 18 pF | Fundamental |
| 24.576000 | **MP245** | MP245-E | Series | Fundamental |
| 24.576000 | MP245B | MP245B-E | 18 pF | Fundamental |
| 25.000000 | **MP250** | MP250-E | Series | Fundamental |
| 25.000000 | MP250A | MP250A-E | 20 pF | Fundamental |
| 25.000000 | MP250B | MP250B-E | 18 pF | Fundamental |
| 27.000000 | MP270 | MP270-E | Series | 3rd Overtone |
| 27.000000 | MP270B | MP270B-E | 18 pF | 3rd Overtone |
| 32.000000 | MP320A | MP320A-E | 20 pF | 3rd Overtone |
| 32.000000 | MP320B | MP320B-E | 18 pF | 3rd Overtone |
| 32.768000 | MP327B | MP327B-E | 18 pF | 3rd Overtone |
| 36.000000 | MP360 | MP360-E | Series | 3rd Overtone |
| 40.000000 | MP400 | MP400-E | 20 pF | 3rd Overtone |
| 48.000000 | MP480 | MP480-E | Series | 3rd Overtone |
| 48.000000 | MP480A | MP480A-E | 20 pF | 3rd Overtone |
| 48.000000 | MP480B | MP480B-E | 18 pF | 3rd Overtone |
| 50.000000 | MP500B | MP500B-E | 18 pF | 3rd Overtone |
| 64.000000 | MP640B | MP640B-E | 18 pF | 3rd Overtone |

## ELECTRICAL CHARACTERISTICS

| | PARAMETER | VALUE |
|---|---|---|
| ELECTRICAL PARAMETERS | 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 *<br>-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 ($C_0$) | 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 |

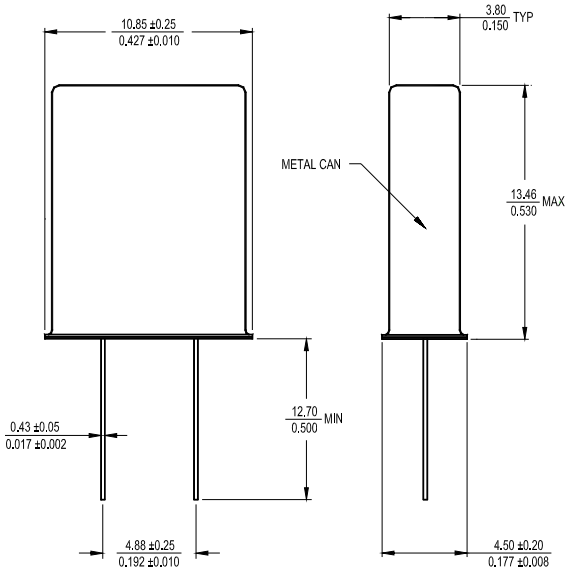
* Custom requirements may be available upon request. Use form C052 to detail non-standard parameters.

## EQUIVALENT SERIES RESISTANCE TABLE

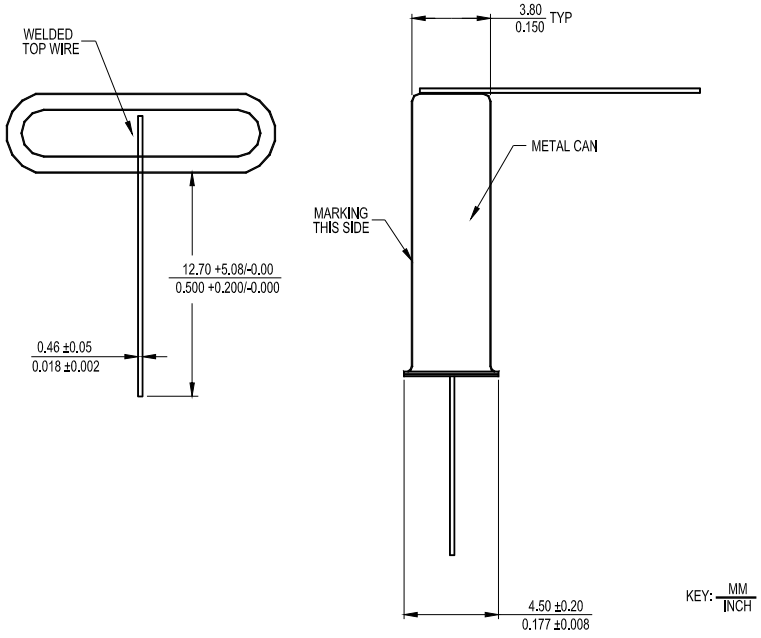
| FREQUENCY RANGE | OSCILLATION MODE | ESR MAXIMUM |
|---|---|---|
| 1.80 MHz - < 2.00 MHz | Fundamental | 600 Ohms |
| 2.00 MHz - < 2.40 MHz | Fundamental | 500 Ohms |
| 2.40 MHz - < 3.00 MHz | Fundamental | 300 Ohms |
| 3.00 MHz - < 3.70 MHz | Fundamental | 200 Ohms |
| 3.70 MHz - < 4.20 MHz | Fundamental | 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




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




### MARKING INFORMATION

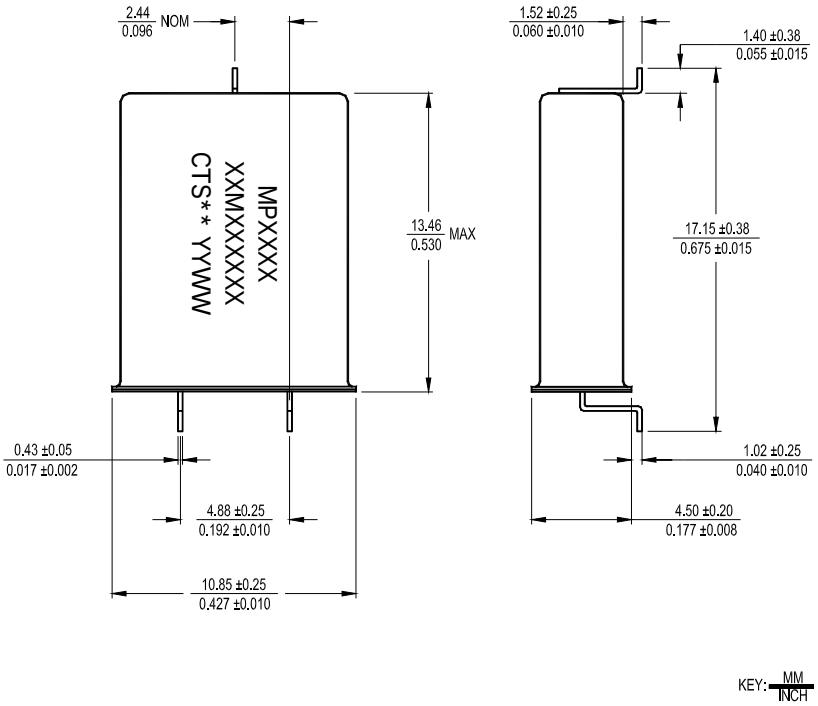
1. MPXXXX - CTS Part Number.
   [See Standard Product Part Numbers tables.]
2. XXMXXXXXX – Frequency is marked with only leading significant digits before the 'M' and 4 – 6 digits after the 'M' (including zeros).
   Ex. XMXXXXXX – 3M579545
   XXMXXXXX – 14M31818
   XXMXXXX – 20M0000
2. ** - Manufacturing 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

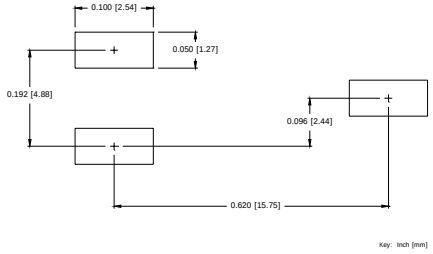
1. Lead finish (e1), SnAgCu.

# MECHANICAL SPECIFICATIONS

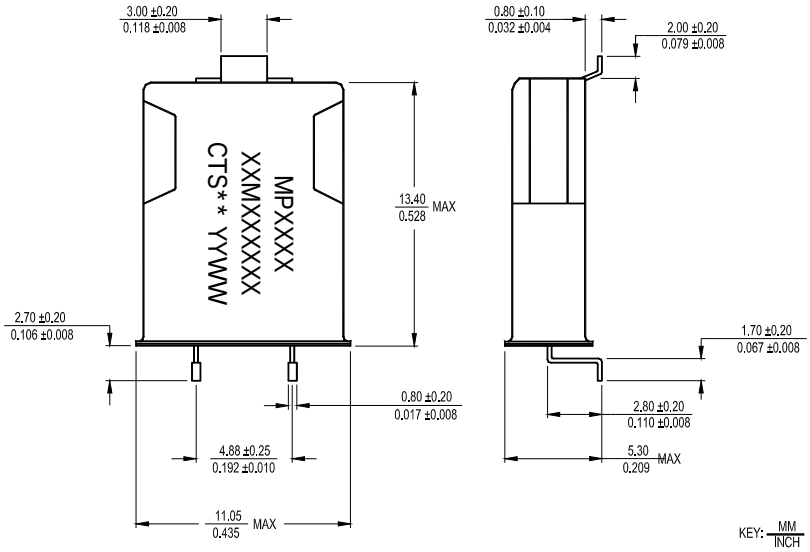
### MP-SM OPTION W/ WELDED TOP WIRE THIRD LEAD



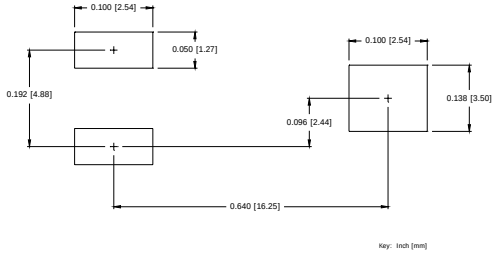

### SUGGESTED SOLDER PAD GEOMETRY




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



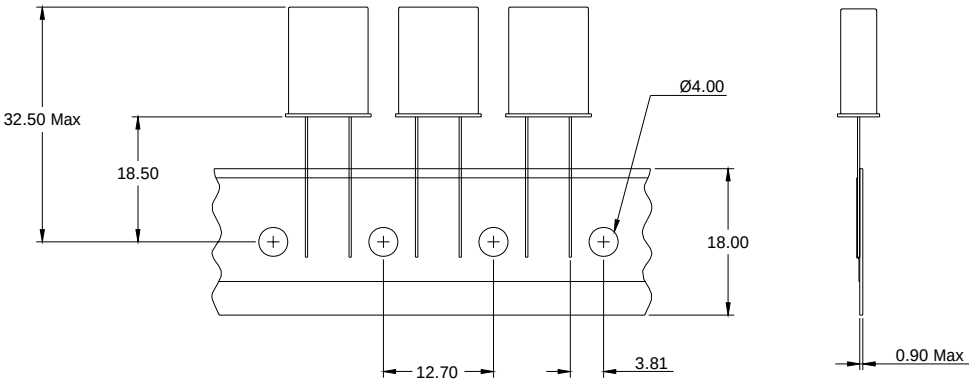

### SUGGESTED SOLDER PAD GEOMETRY



## PACKAGING INFORMATION

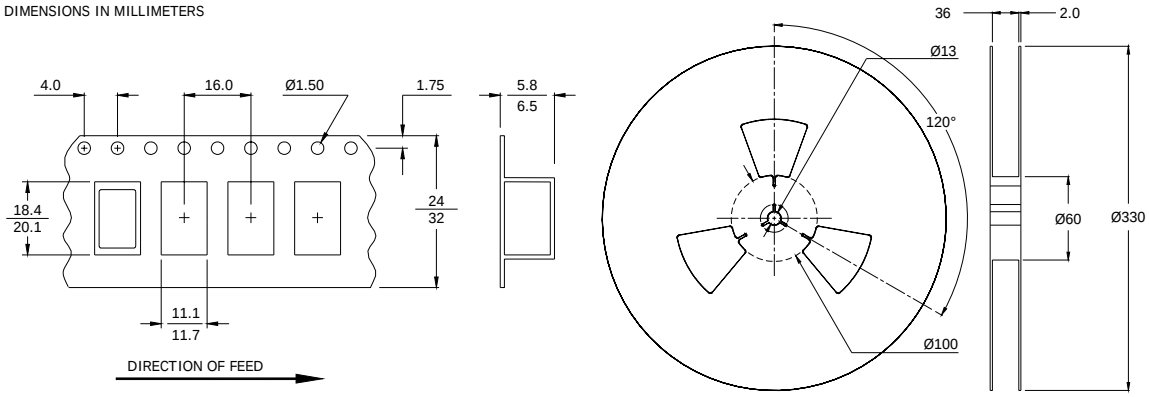
**MP Radial Taping (Ammopak)**

DIMENSIONS IN MILLIMETERS




**MP-SM / MP-SMMC 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 $2x10^{-8}$ ATM cc/sec air equivalent. |
| Resistance to Solder Heat: | Product must survive 3 reflows of +250°C maximum, 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. |