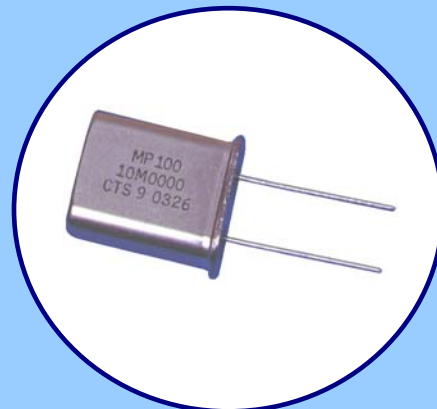


## FEATURES

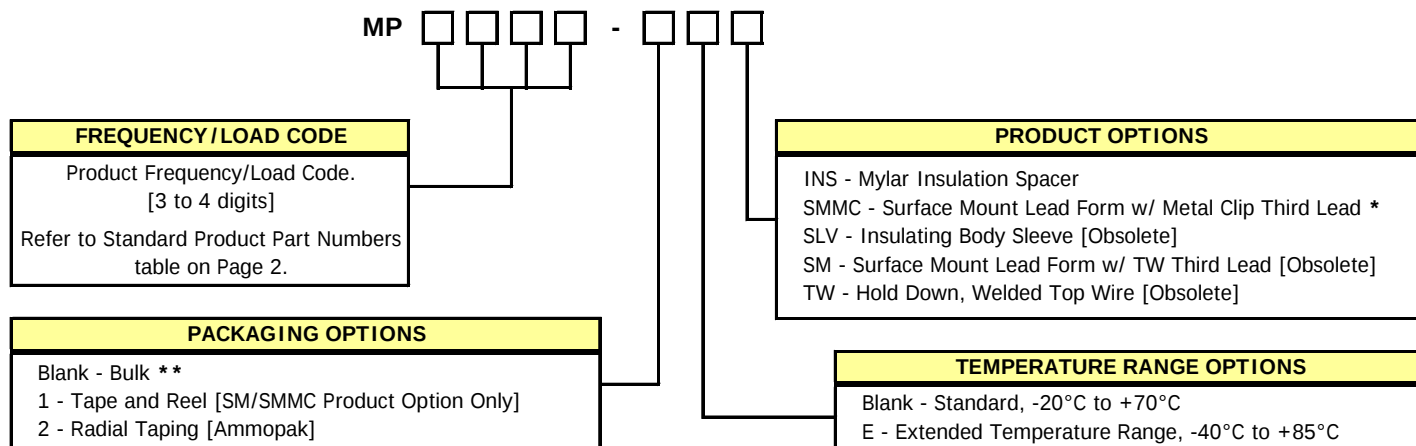
- Standard HC-49/U Package, HC-49/U SMMC Package Option Available
- Stable Frequency Over Temperature and Drive Level
- **Fundamental and 3<sup>rd</sup> Overtone Crystals**
- Frequency Range 1.8432 – 64 MHz
- Frequency Tolerance,  $\pm 30$  ppm Standard
- Frequency Stability,  $\pm 50$  ppm Standard
- Operating Temperature,  $-20^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$  Standard,  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$  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

- Contact your local CTS Representative or CTS Inside Sales Representative 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<br>[M Hz] | PART<br>NUMBER<br>[-20/70°C] | PART<br>NUMBER<br>[-40/85°C] | LOAD<br>CAPACITANCE | OPERATING<br>MODE | FREQUENCY<br>[M Hz] | PART<br>NUMBER<br>[-20/70°C] | PART<br>NUMBER<br>[-40/85°C] | LOAD<br>CAPACITANCE | OPERATING<br>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>MP040</b>                 | MP040-E                      | 20 pF               | Fundamental       | 12.288000           | MP122A                       | MP122A-E                     | 20 pF               | Fundamental       |
| 4.000000            | <b>MP040B</b>                | <b>MP040B-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>MP050</b>                 | MP050-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>MP060</b>                 | MP060-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>MP221A</b>                | MP221A-E                     | Series              | Fundamental       |
| 6.144000            | <b>MP061</b>                 | MP061-E                      | 20 pF               | Fundamental       | 22.118400           | <b>MP221</b>                 | MP221-E                      | 20 pF               | Fundamental       |
| 6.144000            | MP061C                       | MP061C-E                     | 32 pF               | Fundamental       | 22.118400           | MP221B                       | MP221B-E                     | 18 pF               | Fundamental       |
| 6.250000            | MP062                        | MP062-E                      | 30 pF               | Fundamental       | 24.000000           | <b>MP240</b>                 | MP240-E                      | Series              | Fundamental       |
| 6.400000            | MP064                        | MP064-E                      | 20 pF               | Fundamental       | 24.000000           | MP240A                       | MP240A-E                     | 20 pF               | Fundamental       |
| 6.553600            | MP065                        | MP065-E                      | 20 pF               | Fundamental       | 24.000000           | MP240B                       | MP240B-E                     | 18 pF               | Fundamental       |
| 6.553600            | MP065C                       | MP065C-E                     | 12 pF               | Fundamental       | 24.576000           | <b>MP245</b>                 | MP245-E                      | Series              | Fundamental       |
| 7.372800            | <b>MP073</b>                 | MP073-E                      | Series              | Fundamental       | 24.576000           | MP245B                       | MP245B-E                     | 18 pF               | Fundamental       |
| 7.372800            | MP073A                       | MP073A-E                     | 20 pF               | Fundamental       | 25.000000           | <b>MP250</b>                 | MP250-E                      | Series              | Fundamental       |
| 7.372800            | MP073B                       | MP073B-E                     | 18 pF               | Fundamental       | 25.000000           | MP250A                       | MP250A-E                     | 20 pF               | Fundamental       |
| 8.000000            | <b>MP080</b>                 | MP080-E                      | Series              | Fundamental       | 25.000000           | MP250B                       | MP250B-E                     | 18 pF               | Fundamental       |
| 8.000000            | <b>MP080A</b>                | MP080A-E                     | 20 pF               | Fundamental       | 27.000000           | MP270                        | MP270-E                      | Series              | 3rd Overtone      |
| 8.000000            | <b>MP080B</b>                | <b>MP080B-E</b>              | 18 pF               | Fundamental       | 27.000000           | MP270B                       | MP270B-E                     | 18 pF               | 3rd Overtone      |
| 8.000000            | MP080C                       | MP080C-E                     | 32 pF               | Fundamental       | 32.000000           | MP320A                       | MP320A-E                     | 20 pF               | 3rd Overtone      |
| 8.192000            | MP081B                       | MP081B-E                     | 18 pF               | Fundamental       | 32.000000           | MP320B                       | MP320B-E                     | 18 pF               | 3rd Overtone      |
| 9.216000            | MP092B                       | MP092B-E                     | 18 pF               | Fundamental       | 32.768000           | MP327B                       | MP327B-E                     | 18 pF               | 3rd Overtone      |
| 9.830400            | MP098A                       | MP098A-E                     | Series              | Fundamental       | 36.000000           | MP360                        | MP360-E                      | Series              | 3rd Overtone      |
| 9.830400            | <b>MP098</b>                 | MP098-E                      | 20 pF               | Fundamental       | 40.000000           | MP400                        | MP400-E                      | 20 pF               | 3rd Overtone      |
| 9.830400            | <b>MP098B</b>                | <b>MP098B-E</b>              | 18 pF               | Fundamental       | 48.000000           | MP480                        | MP480-E                      | Series              | 3rd Overtone      |
| 10.000000           | <b>MP100</b>                 | MP100-E                      | Series              | Fundamental       | 48.000000           | MP480A                       | MP480A-E                     | 20 pF               | 3rd Overtone      |
| 10.000000           | MP100A                       | MP100A-E                     | 20 pF               | Fundamental       | 48.000000           | MP480B                       | MP480B-E                     | 18 pF               | 3rd Overtone      |
| 10.000000           | MP100B                       | MP100B-E                     | 18 pF               | Fundamental       | 50.000000           | <b>MP500B</b>                | <b>MP500B-E</b>              | 18 pF               | 3rd Overtone      |
| 10.000000           | <b>MP101</b>                 | MP101-E                      | 30 pF               | Fundamental       | 64.000000           | MP640B                       | MP640B-E                     | 18 pF               | 3rd Overtone      |

**ELECTRICAL CHARACTERISTICS**

| ELECTRICAL PARAMETERS | PARAMETER                                                                                  | VALUE                                                                  |
|-----------------------|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
|                       | 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<br>(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 <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                                   |
|                       | Insulation Resistance                                                                      | 500 Ohms @ DC 100V                                                     |
|                       | 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.

**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  
XXMXXXXXX - 20M0000
2. \*\* - Manufacturing Site Code.
3. YWW - 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.
2. MSL = 1.

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



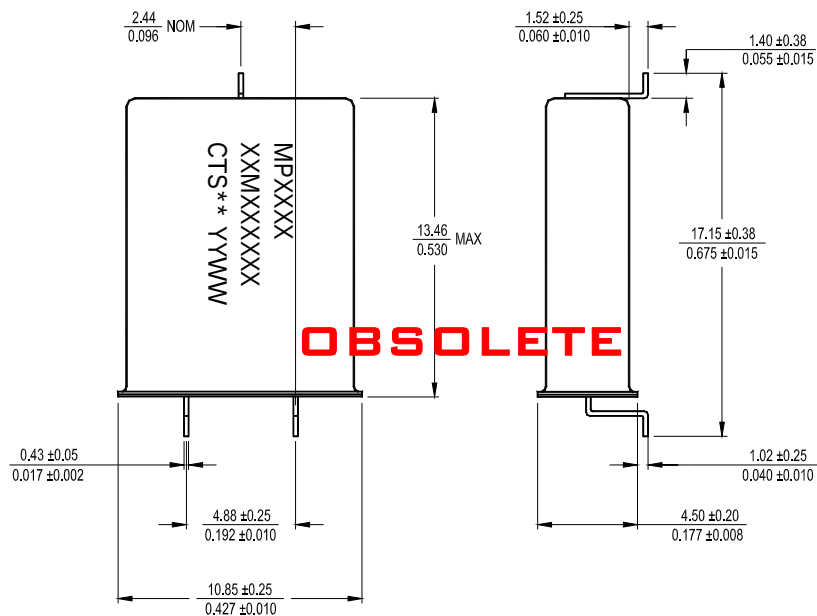
KEY:  $\frac{\text{MM}}{\text{INCH}}$

### SUGGESTED SOLDER PAD GEOMETRY



## MECHANICAL SPECIFICATIONS

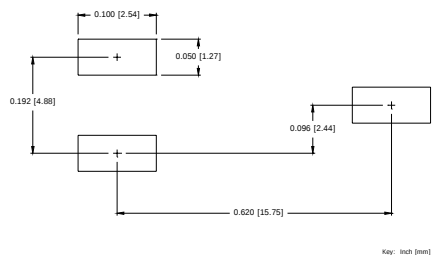
### MP-SM OPTION w/ WELDED TOP WIRE THIRD LEAD



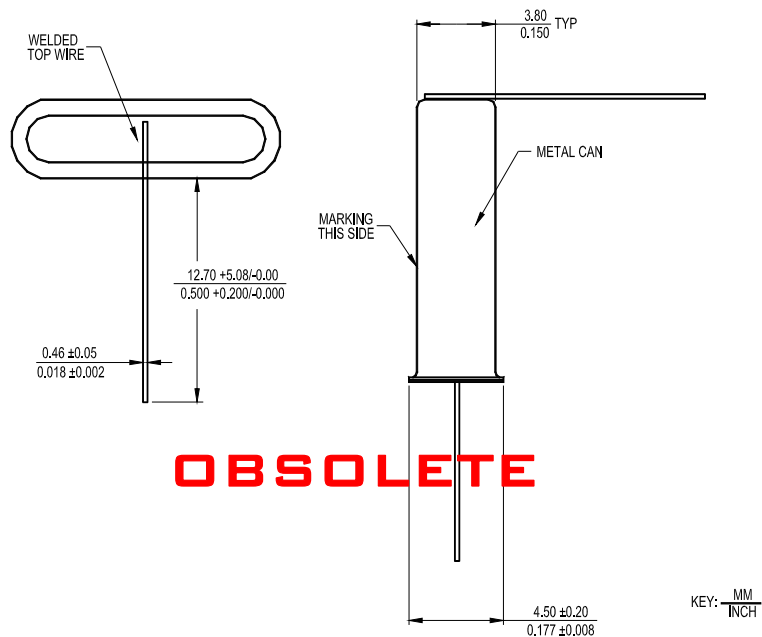
**OBsolete**

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

### SUGGESTED SOLDER PAD GEOMETRY



### MP PACKAGE w/ WELDED TOP WIRE [TW] OPTION



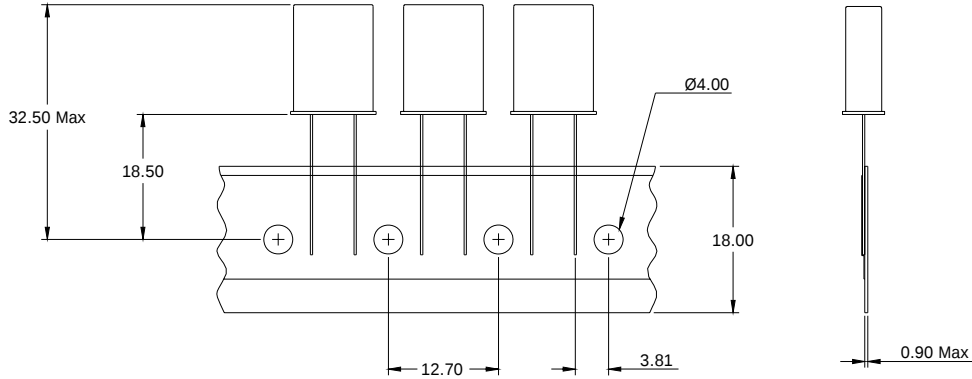
**OBsolete**

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

**PACKAGING INFORMATION [Reference Only]**

**MP Radial Taping [Ammopak]**

DIMENSIONS IN MILLIMETERS



**MP-SMMC Tape and Reel**

DIMENSIONS IN MILLIMETERS

