

## Precision Surface Mount Resistors Wirewound or Metal Film Technologies



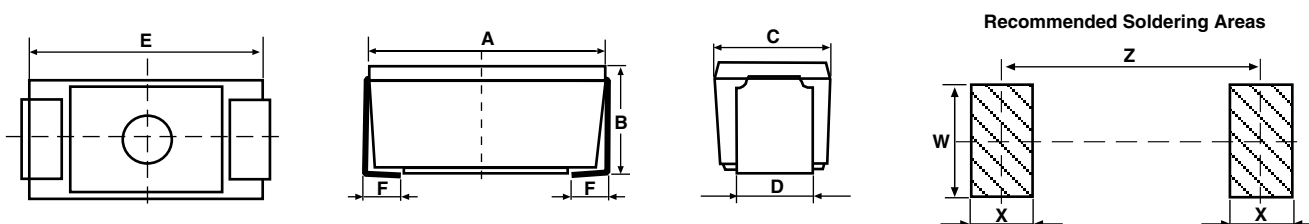
### FEATURES

- According to CECC 40402-801 (wirewound)
- Wide range of ohmic values (0.04  $\Omega$  to 1 M $\Omega$ )
- Low temperature coefficient ( $\pm 25$  ppm/ $^{\circ}\text{C}$  available)
- Good electrical insulation
- All welded construction and molded encapsulant
- High power ratings (up to 2.5 W)
- Stability class 0.5
- Pure matte tin termination
- Material categorization: for definitions of compliance please see [www.vishay.com/doc299912](http://www.vishay.com/doc299912)


**RoHS**  
COMPLIANT

Specially designed for surface mounting, the MSP series uses either wirewound or metal film technology. The molded package ensures mechanical and climatic protection as well as high dielectric insulation. The MSP design is compatible with surface mounting equipment and can withstand wave and reflow soldering techniques.

### DIMENSIONS in millimeters



| SERIES | A    | B   | C   | D   | E    | F   | W   | X   | Z    | WEIGHT in g |
|--------|------|-----|-----|-----|------|-----|-----|-----|------|-------------|
| MSP 1  | 6.9  | 3.8 | 3.8 | 2.5 | 6.5  | 1.4 | 2.7 | 2.9 | 6    | 0.2         |
| MSP 2  | 11.4 | 5   | 7   | 5   | 11   | 2.4 | 5.2 | 4.1 | 9.4  | 0.8         |
| MSP 3  | 14.8 | 6.6 | 7   | 5   | 14.4 | 2.4 | 5.2 | 4.1 | 12.7 | 1.5         |

#### Note

- General tolerance:  $\pm 0.2$  mm

### STANDARD ELECTRICAL SPECIFICATIONS

| MODEL   | RESISTANCE RANGE<br>$\Omega$ | RATED POWER<br>$P_{25^{\circ}\text{C}}$<br>W | LIMITING ELEMENT VOLTAGE<br>V | TOLERANCE<br>$\pm \%$ | TEMPERATURE COEFFICIENT<br>$\pm$ ppm/ $^{\circ}\text{C}$ |
|---------|------------------------------|----------------------------------------------|-------------------------------|-----------------------|----------------------------------------------------------|
| MSP 1 B | 0.04 to 2.2K                 | 1                                            | 50                            | 0.5, 1, 2, 5          | 25, 50, 100                                              |
| MSP 2 B | 0.04 to 4.7K                 | 2                                            | 120                           | 0.5, 1, 2, 5          | 25, 50, 100                                              |
| MSP 3 B | 0.04 to 13K                  | 2.5                                          | 200                           | 0.5, 1, 2, 5          | 25, 50, 100                                              |
| MSP 1 C | 10 to 332K                   | 0.5                                          | 300                           | 0.5, 1                | 25, 50                                                   |
| MSP 2 C | 10 to 1M                     | 1                                            | 350                           | 0.5, 1                | 25, 50                                                   |

**TECHNICAL SPECIFICATIONS**

| RESISTIVE TECHNOLOGY                                                     |                    | WIREWOUND                                                                                                   |                           |                                | METAL FILM                                                                           |          |
|--------------------------------------------------------------------------|--------------------|-------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------|--------------------------------------------------------------------------------------|----------|
| Vishay Sfernice Series                                                   |                    | MSP 1 B                                                                                                     | MSP 2 B                   | MSP 3 B                        | MSP 1 C                                                                              | MSP 2 C  |
| Metric Size                                                              |                    | 0704M                                                                                                       | 1107M                     | 1607M                          | 0704M                                                                                | 1107M    |
| Rated Dissipation at +25 °C, $P_{25}$                                    |                    | 1 W                                                                                                         | 2 W                       | 2.5 W                          | 0.5 W                                                                                | 1 W      |
| Ohmic Range in Relation to Tolerance (with Preferred Ohmic Value Series) | ± 5 % E24 Series   | 0.04 to 2.2K                                                                                                | 0.04 to 4.7K              | 0.04 to 13K                    | -                                                                                    | -        |
|                                                                          | ± 2 % E48 Series   | 0.1 to 2.2K                                                                                                 | 0.04 to 4.7K              | 0.05 to 13K                    | -                                                                                    | -        |
|                                                                          | ± 1 % E96 Series   | 0.1 to 2.2K                                                                                                 | 0.04 to 4.7K              | 0.05 to 13K                    | 10 to 332K                                                                           | 10 to 1M |
|                                                                          | ± 0.5 % E96 Series | 1.4 to 2.2K                                                                                                 | 0.4 to 4.7K               | 0.3 to 13K                     | 10 to 332K                                                                           | 10 to 1M |
| Limiting Element Voltage, $U_{max}$ . AC/DC                              |                    | 50 V                                                                                                        | 120 V                     | 200 V                          | 300 V                                                                                | 350 V    |
| Series                                                                   |                    | MSP 1 B                                                                                                     | MSP 2 B                   | MSP 3 B                        | MSP 1 C                                                                              | MSP 2 C  |
| Critical Resistance                                                      |                    | -                                                                                                           | -                         | -                              | 180K                                                                                 | 122.5K   |
| Temperature Coefficient                                                  |                    | CECC 40402-801<br>-55 °C / +200 °C<br>< 1 Ω ± 100 ppm/°C<br>1 Ω to < 10 Ω ± 50 ppm/°C<br>≥ 10 Ω ± 25 ppm/°C |                           |                                | -55 °C / +155 °C<br>10 Ω to 332 kΩ<br>K3: ± 50 ppm/°C<br>K4: ± 25 ppm/°C<br>> 332 kΩ |          |
| Failure Rate                                                             |                    | E6<br>10 <sup>-6</sup> /h                                                                                   | E6<br>10 <sup>-6</sup> /h | E0 or A<br>10 <sup>-4</sup> /h | -                                                                                    | -        |

**MECHANICAL SPECIFICATIONS**

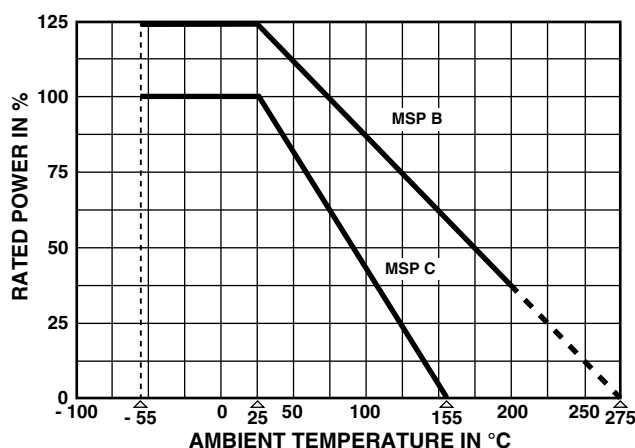
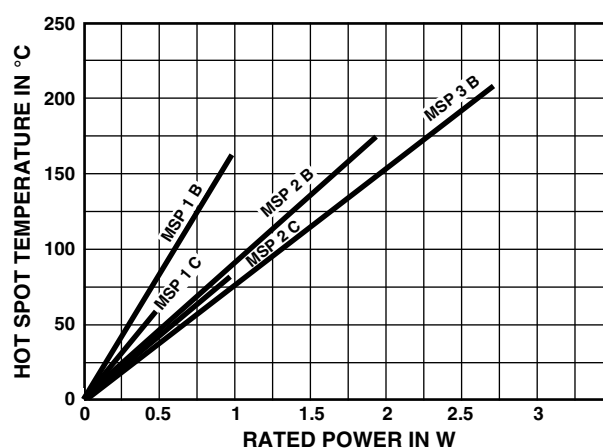
| RESISTIVE TECHNOLOGY | Wirewound                   | Metal Film  |
|----------------------|-----------------------------|-------------|
| Encapsulant          | Thermoset                   |             |
| Resistive Element    | CuNi or NiCr                | NiCr or NiP |
| Ceramic Substrate    | Alumina or Steatite         | Alumina     |
| Termination          | Electrolytic pure matte tin |             |

**ENVIRONMENTAL SPECIFICATIONS**

| RESISTIVE TECHNOLOGY             | Wirewound        | Metal Film       |
|----------------------------------|------------------|------------------|
| Temperature Range                | -55 °C to 275 °C | -55 °C to 155 °C |
| Climatic Category (LCT/UCT/days) | 55/200/56        | 55/125/10        |



| PERFORMANCE                  |                                                                                                                  |            |                                                      |            |
|------------------------------|------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------------------|------------|
| TESTS                        | CONDITIONS                                                                                                       |            | REQUIREMENTS                                         |            |
|                              | Wirewound                                                                                                        | Metal Film | Wirewound<br>CECC 40402-801                          | Metal Film |
| Short Time Overload          | IEC 60115-1<br>5 P <sub>r</sub> or U = 2 U <sub>max</sub> /5 s                                                   |            | ± (0.25 % + 0.05 Ω)                                  | ± 0.25 %   |
| Load Life                    | IEC 60115-1<br>90'/30' cycles<br>1000 h P <sub>r</sub> + 25 °C<br>8000 h P <sub>r</sub>                          |            | ± (0.5 % + 0.05 Ω)<br>± (3 % + 0.05 Ω)               | ± 1 %<br>- |
| Dielectric w/s Voltage       | IEC 60115-1<br>U <sub>RMS</sub> = 500 V/60 s                                                                     |            | No flashover or breakdown<br>Leakage current < 10 μA |            |
| Rapid Change of Temperature  | IEC 60115-1<br>IEC 60068-2-14 Test Na<br>5 cycles (30' at LCT/30' at UCT)<br>-55 °C / +200 °C   -55 °C / +125 °C |            | ± (0.25 % + 0.05 Ω)                                  | ± 0.25 %   |
| Climatic Sequence            | IEC 60115-1<br>-55 °C / +200 °C   -55 °C / +125 °C                                                               |            | ± (0.5 % + 0.05 Ω)                                   | ± 0.5 %    |
| Humidity (Steady State)      | IEC 60115-1<br>IEC 60068-2-3 Test Ca<br>95 % HR/40 °C<br>56 days   10 days                                       |            | ± (0.5 % + 0.05 Ω)                                   | ± 1 %      |
| Substrate Bending Test       | IEC 60115-1<br>IEC 60068-2-21 Test U <sub>e3</sub><br>2 mm/10 times                                              |            | ± (0.25 % + 0.05 Ω)                                  | ± 0.25 %   |
| Shock                        | IEC 60115-1<br>IEC 60068-2-27 Test Ea<br>50 g's/half sine/3 times by direction (i.e. 18 shocks)                  |            | ± (0.25 % + 0.05 Ω)                                  | n/a        |
| Vibration                    | IEC 60115-1<br>IEC 60068-2-6 Test Fc<br>10 Hz/2000 Hz   10 Hz/500 Hz                                             |            | ± (0.25 % + 0.05 Ω)                                  | ± 0.25 %   |
| Resistance to Soldering Heat | IEC 60115-1<br>IEC 60068-2-58 Solder bath<br>260 °C/10 s                                                         |            | ± (0.5 % + 0.05 Ω)                                   | n/a        |

**POWER RATING****TEMPERATURE RISE****SURFACE MOUNTING OF MSP B**

Soldering cycle: 2 min at 215 °C or 10 s at 260 °C or with an iron 40 W: 3 s at 350 °C.

Soldering is possible by wave, reflow and vapor phase.

**NON INDUCTIVE WINDING FOR MSP B**

Non-inductive (Ayrton Perry) winding available.

Please consult Vishay Sfernice.

## PACKAGING

In bulk (plastic bag of 100 units or multiples)

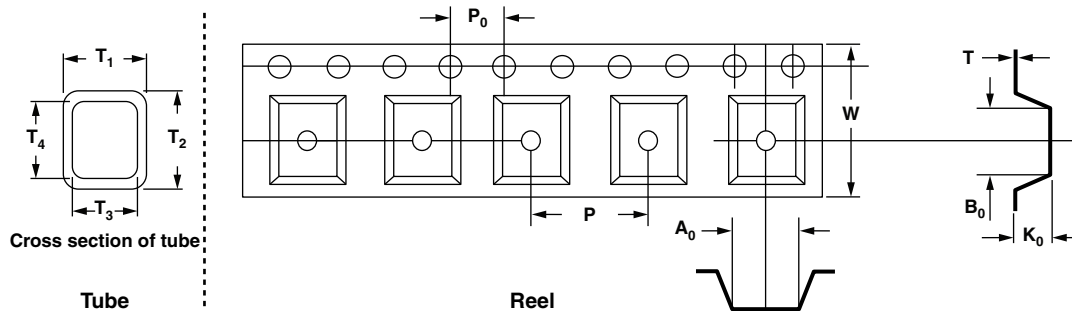
In tube: MSP1 70 units per tube

MSP2 50 units per tube

MSP3 40 units per tube

In reel of 500 units for MSP1 and MSP2

## DIMENSIONS in millimeters - Informative Data



|              | TUBE PACKAGING |     |     |     |        | REEL PACKAGING |       |      |    |    |       |    |
|--------------|----------------|-----|-----|-----|--------|----------------|-------|------|----|----|-------|----|
|              | T1             | T2  | T3  | T4  | LENGTH | A0             | B0    | K0   | P0 | W  | T     | P  |
| <b>MSP 1</b> | 6.6            | 6.8 | 4.6 | 4.8 | 530    | 3.9            | 7.35  | 4.25 | 4  | 12 | 0.254 | 8  |
| <b>MSP 2</b> | 9.2            | 8.7 | 8   | 7.5 | 615    | 7.43           | 11.91 | 5.36 | 4  | 24 | 0.368 | 12 |
| <b>MSP 3</b> |                |     |     |     |        | N/A            |       |      |    |    |       |    |

## MARKING

Vishay Sfernice trademark, ohmic value (in  $\Omega$ ), tolerance (in %), series and style, technology, manufacturing date.

## ORDERING INFORMATION

|            |          |                               |                       |             |                             |                                   |              |                |
|------------|----------|-------------------------------|-----------------------|-------------|-----------------------------|-----------------------------------|--------------|----------------|
| <b>MSP</b> | <b>1</b> | <b>B</b>                      |                       | <b>48U7</b> | <b><math>\pm 1\%</math></b> | <b>TC</b>                         | <b>BA100</b> | <b>e3</b>      |
| SERIES     | STYLE    | TECHNOLOGY                    | NON INDUCTIVE WINDING | OHMIC VALUE | TOLERANCE                   | Applicable only in "C" technology | PACKAGING    | LEAD (Pb)-FREE |
|            |          | B: Wirewound<br>C: Metal Film | Optional              |             |                             |                                   |              |                |

## SAP PART NUMBERING GUIDELINES

|              |                                             |                                                                   |                                                                                                                                                                                                                                                |   |   |   |   |                                                        |                                                                                                |                                                                                                                                 |   |  |               |               |   |   |   |
|--------------|---------------------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|--------------------------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---|--|---------------|---------------|---|---|---|
| M            | S                                           | P                                                                 |                                                                                                                                                                                                                                                | 1 | B | 4 | 8 | R                                                      | 7                                                                                              | 0                                                                                                                               | F |  | T             | 2             | 0 | E | 3 |
| GLOBAL MODEL | OPTION                                      | SIZE                                                              | OHMIC VALUE                                                                                                                                                                                                                                    |   |   |   |   | TOL.                                                   | TEMP. COEF.                                                                                    | PACKAGING                                                                                                                       |   |  | SPECIAL       | RoHS          |   |   |   |
| MSP          | Blank<br>or<br>N<br>(non inductive winding) | 1B<br>2B<br>3B<br>1C<br>2C<br><br>B = wirewound<br>C = metal film | The first four digits are significant figures and the last digit specifies the number of zeros to follow.<br>R designates decimal point.<br>48R70 = 48.7 Ω<br>48701 = 48 700 Ω<br>10002 = 100 000 Ω<br>R0100 = 0.01 Ω<br>R4700 = 0.47 Ω<br>... |   |   |   |   | B = 0.1 %<br>F = 1 %<br>G = 2 %<br>J = 5 %<br>K = 10 % | Blank<br>or<br>applicable only on metal film technologies 1C and 2C:<br>H ≥ K3<br>or<br>E ≥ K4 | S14 = bag (100 pieces)<br>R10 = reel (500 pieces)<br>T25 = tube (70 pieces)<br>T17 = tube (40 pieces)<br>T20 = tube (50 pieces) |   |  | As applicable | E3 = pure tin |   |   |   |



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