

# DATA SHEET

## METAL FILM RESISTORS

General Purpose

MFR Series

$\pm 0.5\%$ ,  $\pm 1\%$ ,  $\pm 2\%$ ,  $\pm 5\%$

1/6W to 3W

RoHS compliant & Halogen Free





**ORDERING INFORMATION**

Part number of the general purpose metal film resistor are identified by the series, power rating, tolerance, packing, temperature coefficient, forming and resistance value.

**APPLICATIONS**

- All general purpose applications
- Power applications

**FEATURES**

- AEC-Q200 qualified
- Wide resistance range
- PPAP ready (MFR-25/MFR50S/MFR-50)
- High stability
- RoHS compliant & halogen-free

**PART NUMBER**

MFR    200    F    T    F    73-    100R  
(1)    (2)    (3)    (4)    (5)    (6)    (7)

**(1) SERIES**

MFR Series

**(2) POWER RATING**

|            |            |          |
|------------|------------|----------|
| -12 = 1/6W | -50 = 1/2W | 200 = 2W |
| 25S = 1/4W | 100 = 1W   | 3WS = 3W |
| -25 = 1/4W | 2WS = 2W   | 1WS = 1W |
| 50S = 1/2W |            |          |

**(3) TOLERANCE**

|           |         |         |
|-----------|---------|---------|
| D = ±0.5% | F = ±1% | G = ±2% |
| J = ±5%   |         |         |

**(4) PACKAGING**

|               |              |          |
|---------------|--------------|----------|
| R = Reel Pack | T = Box Pack | B = Bulk |
|---------------|--------------|----------|

**(5) TEMPERATURE COEFFICIENT OF RESISTANCE**

|             |              |                   |
|-------------|--------------|-------------------|
| E=±50ppm/°C | F=±100ppm/°C | - = Based on spec |
|-------------|--------------|-------------------|

**(6) FORMING**

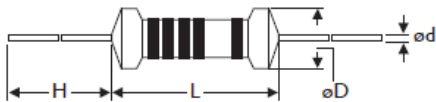
|  |                              |
|--|------------------------------|
| 26- = 26mm                                   | FFK = F-form Kink            |
| 52- = 52.4mm                                 | FKK = FKK Type               |
| 73- = 73mm                                   | MT = MT Type Forming         |
| M = M-Type Forming                           | FT = FT Type Forming         |
| MB = M-form W/fla                            | PN = PANAsert                |
| F = F Type                                   | AV = AVIsert                 |
| FK = FK Type                                 | FB- = FB- Type (for -25&50S) |
| 52A=52.4mm, ψd 0.4±0.02mm                    |                              |
| 52B=52.4mm, ψd 0.45±0.02mm                   |                              |
| 52C=52.4mm, ψd 0.5±0.02mm                    |                              |
| 52G=52.4mm, ψd ≥ 0.6mm                       |                              |
| 52H=52.4mm , non-painting on soldering spots |                              |

**(7) RESISTANCE VALUE**

E24 & E96 & E192 Series  
 Example:  
 100R = 100Ω, 10K = 10,000Ω, 1M = 1,000,000Ω

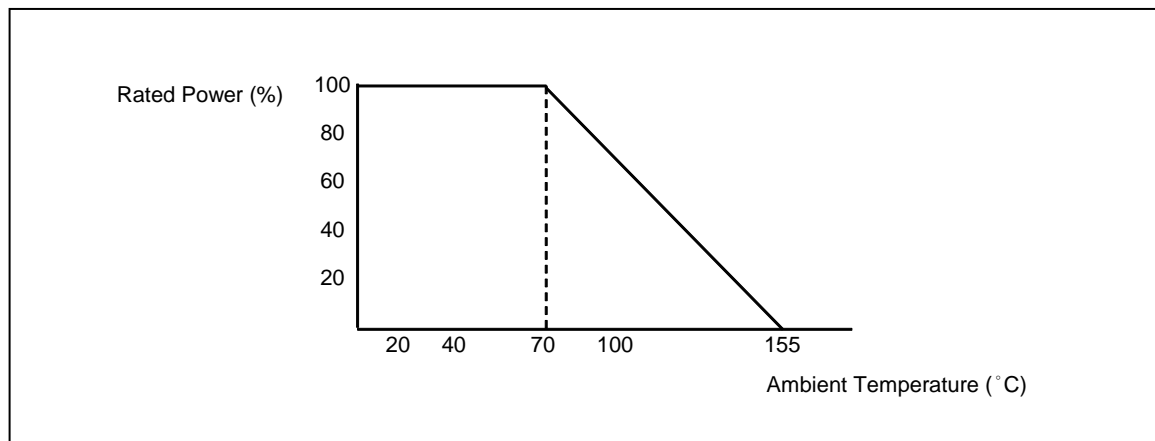
**DIMENSIONS**

Unit: mm



|        | Normal | Miniature  | L         | ψD       | H           | ϕd |
|--------|--------|------------|-----------|----------|-------------|----|
| MFR-12 | MFR25S | 3.4 ± 0.3  | 1.9 ± 0.2 | 28 ± 2.0 | 0.45 ± 0.05 |    |
| MFR-25 | MFR50S | 6.3 ± 0.5  | 2.4 ± 0.2 | 28 ± 2.0 | 0.55 ± 0.05 |    |
| MFR-50 | MFR1WS | 9.0 ± 0.5  | 3.3 ± 0.3 | 26 ± 2.0 | 0.55 ± 0.05 |    |
| MFR100 | MFR2WS | 11.5 ± 1.0 | 4.5 ± 0.5 | 35 ± 2.0 | 0.8 ± 0.05  |    |
| MFR200 | MFR3WS | 15.5 ± 1.0 | 5.0 ± 0.5 | 33 ± 2.0 | 0.8 ± 0.05  |    |

**DERATING CURVE**



**ELECTRICAL CHARACTERISTICS**

| CHARACTERISTICS             | MFR-12                               | MFR25S | MFR-25 | MFR50S | MFR-50 | MFR1WS | MFR100 | MFR2WS<br>MFR200 | MFR3WS |
|-----------------------------|--------------------------------------|--------|--------|--------|--------|--------|--------|------------------|--------|
| Power Rating at 70 °C       | 1/6W                                 | 1/4W   | 1/4W   | 1/2W   | 1/2W   | 1W     | 1W     | 2W               | 3W     |
| Maximum Working Voltage     | 200V                                 | 200V   | 250V   | 300V   | 350V   | 400V   | 500V   | 500V             | 500V   |
| Maximum Overload Voltage    | 400V                                 | 400V   | 500V   | 600V   | 700V   | 800V   | 1000V  | 1000V            | 1000V  |
| Voltage Proof on Insulation | 300V                                 | 400V   | 500V   | 500V   | 500V   | 700V   | 1000V  | 1000V            | 1000V  |
| Resistance Range            | 1Ω ~ 4M7Ω for E24 & E96 series value |        |        |        |        |        |        |                  |        |
| Operating Temp. Range       | - 55°C to +155°C                     |        |        |        |        |        |        |                  |        |
| Temperature Coefficient     | ±50ppm/°C , ±100ppm/°C               |        |        |        |        |        |        |                  |        |

Note: For resistance value out of above range is by request.

**TEST AND REQUIRMENTS**

| TEST                          | TEST METHOD      | PROCEDURE   | APPRAISE                                  |
|-------------------------------|------------------|---|---|
| Short Time Overload           | IEC 60115-1 4.13 | 2.5 times RCWV for 5 sec.(Not more than maximum overload voltage)                   | $\pm 0.25\% + 0.05\Omega$                 |
| Voltage Proof on Insulation   | IEC 60115-1 4.7  | In V-Block for 60 sec. test voltage as above table                                  | No Breakdown                              |
| Temperature Coefficient       | IEC 60115-1 4.8  | Between -55°C to +155°C   | By Type                                   |
| Insulation Resistance         | IEC 60115-1 4.6  | In V-Block for 60 sec.  | >10,000M $\Omega$                         |
| Solderability                 | IEC 60115-1 4.17 | 245 $\pm$ 5°C for 3 $\pm$ 0.5 Sec.  | 95% Min. coverage                         |
| Solvent Resistance of Marking | IEC 60115-1 4.30 | IPA for 5 $\pm$ 0.5 Min. with ultrasonic  | No deterioration of coatings and markings |
| Robustness of Terminations    | IEC 60115-1 4.16 | Direct load for 10 Sec. in the direction of the terminal leads                      | $\geq 2.5\text{Kg}(24.5\text{N})$         |
| Periodic-pulse Overload       | IEC 60115-1 4.39 | 4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec.off)                                  | $\pm 1.0\% + 0.05\Omega$                  |
| Damp Heat Steady State        | IEC 60115-1 4.24 | 40 $\pm$ 2°C,90-95% RH for 56 days, loaded with 0.1 times RCWV                      | $\pm 1.5\% + 0.05\Omega$                  |
| Endurance at 70°C             | IEC 60115-1 4.25 | 70 $\pm$ 2°C at RCWV(or Umax., whichever less) for 1,000 Hr.(1.5 Hr.on,0.5 Hr. off) | $\pm 1.5\% + 0.05\Omega$                  |
| Temperature Cycling           | IEC 60115-1 4.19 | → -55°C → Room Temp. → +155°C Room Temp.(5 cycles)                                  | $\pm 0.75\% + 0.05\Omega$                 |
| Resistance to Soldering Heat  | IEC 60115-1 4.18 | 260 $\pm$ 3°C for 10 $\pm$ 1 Sec., immersed to a point 3 $\pm$ 0.5mm from the body  | $\pm 0.25\% + 0.05\Omega$                 |

Note:

**RCWV (Rated Continuous Working Voltage ):**

The DC or AC (rms) continuous working voltage corresponding to the rated power is determined by the following formula:

$$V = \sqrt{P \times R}$$

or max. working voltage whichever is less

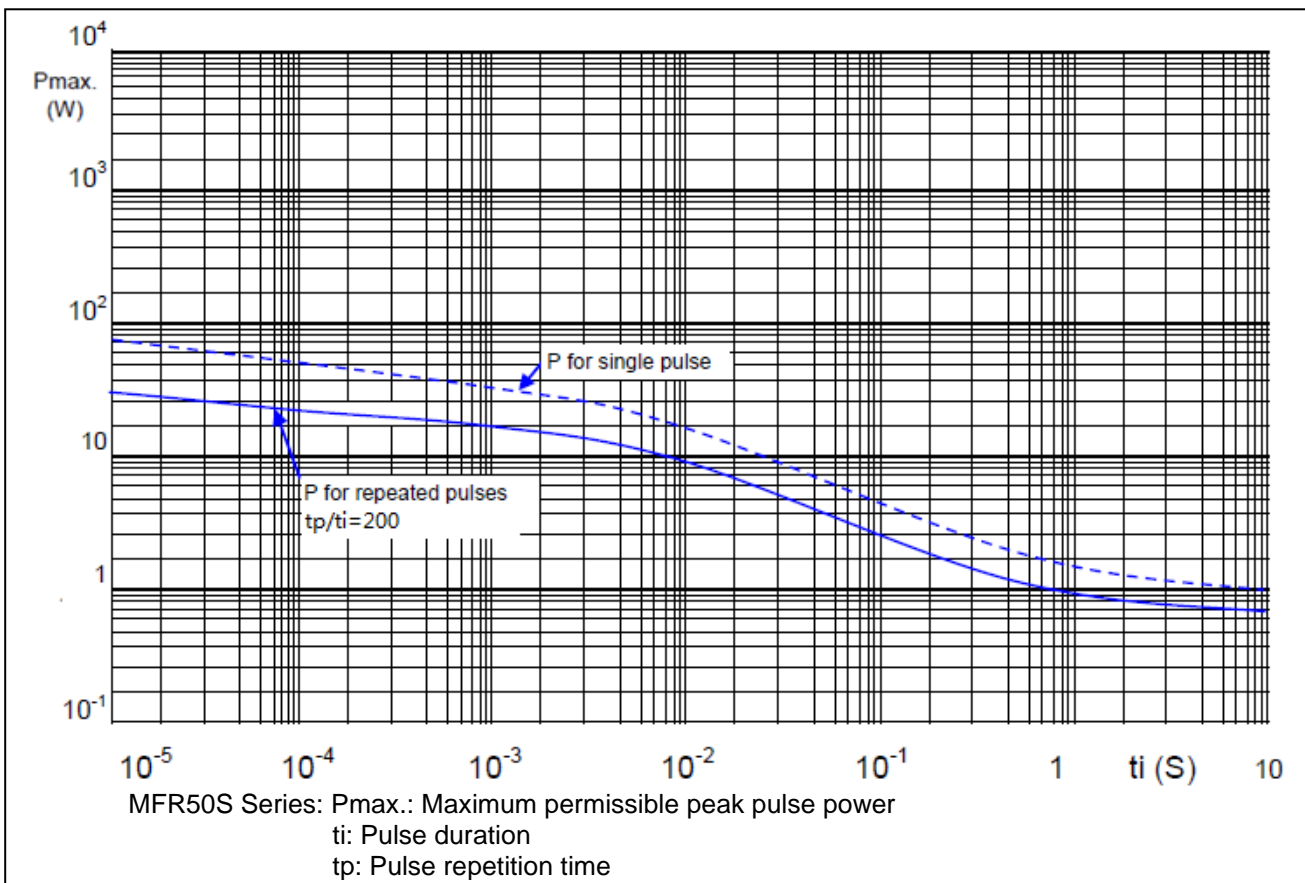
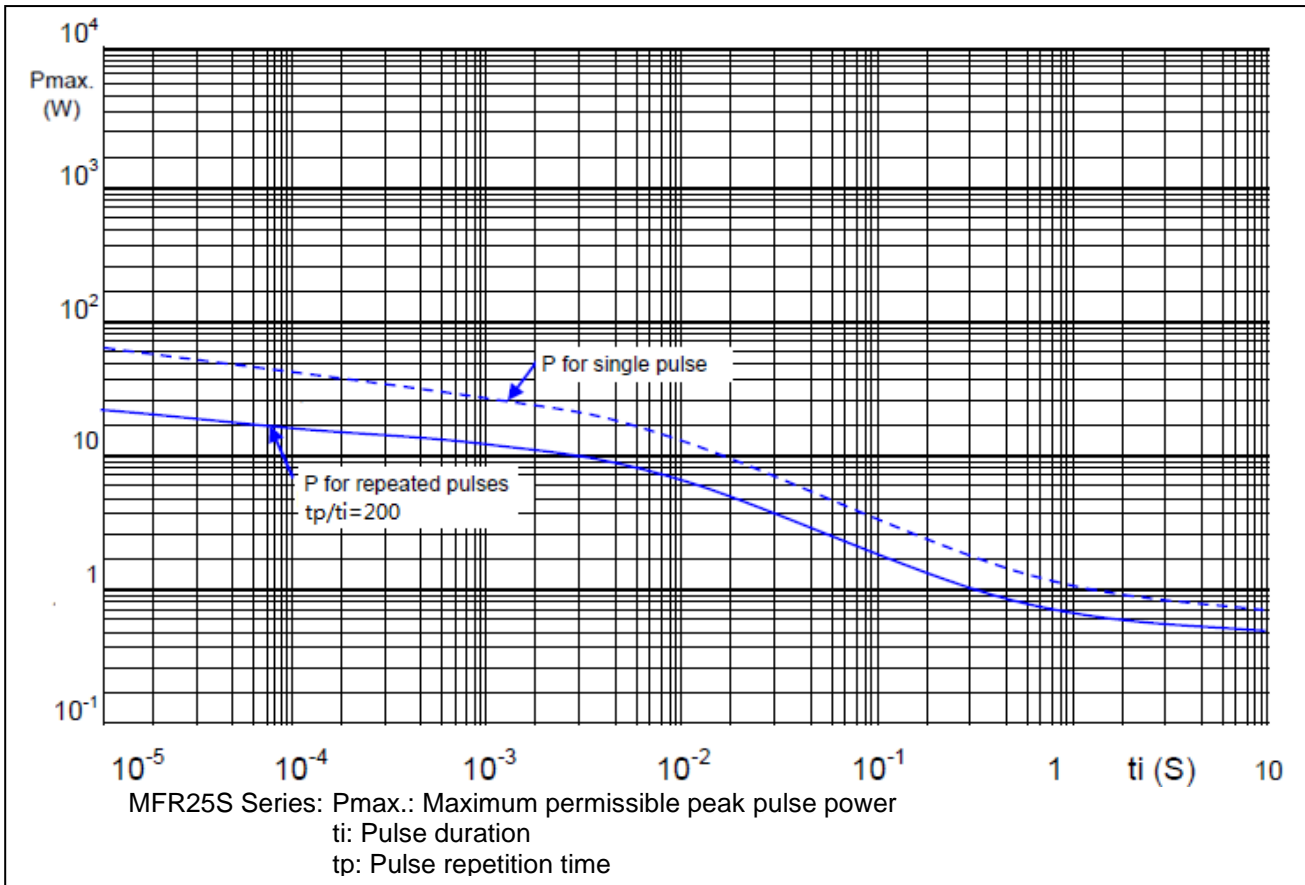
Where

V=Continuous rated DC or  
AC (rms) working voltage (V)

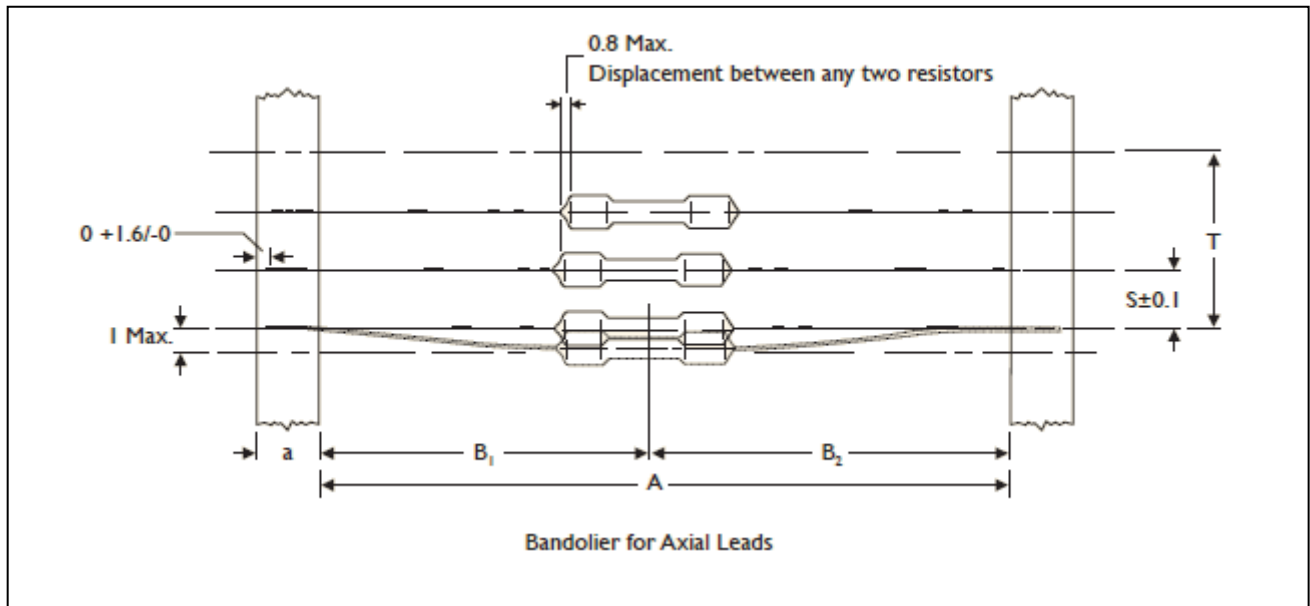
P=Rated power (W)

R=Resistance value ( $\Omega$ )

**PULSE DIAGRAMS**



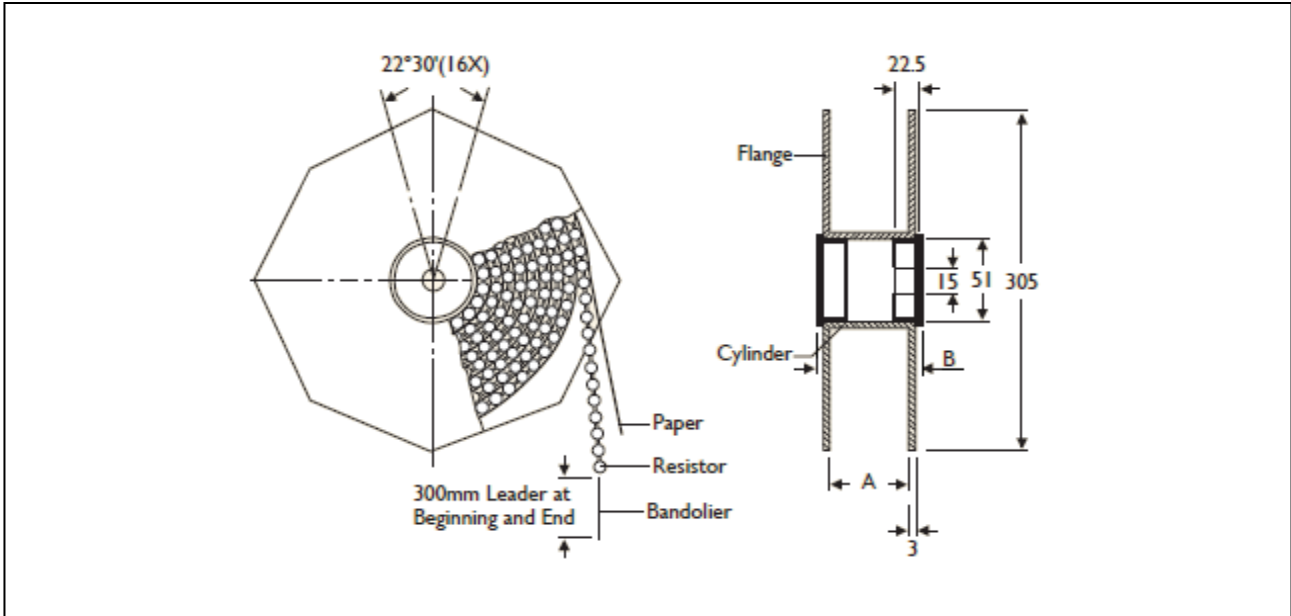
**AXIAL / REEL TAPE SPECIFICATION**



Unit: mm

| Normal | Miniature | a       | A          | B1-B2 (Max.) | S (spacing) | T (max. deviation of spacing)                |
|--------|-----------|---------|------------|--------------|-------------|--|
| MFR-12 | MFR25S    | 6 ± 0.5 | 52.4 ± 1.5 | 1.2          | 5           | 1 mm per 10 spacing,<br>0.5 mm per 5 spacing |
|        |           |         | 26.0 ± 1.5 | 1.0          |             |  |
| MFR-25 | MFR50S    | 6 ± 0.5 | 52.4 ± 1.5 | 1.2          | 5           |  |
|        |           |         | 26.0 ± 1.5 | 1.0          |             |  |
| MFR-50 | MFR1WS    | 6 ± 0.5 | 52.4 ± 1.5 | 1.2          | 5           |  |
| MFR100 | MFR2WS    | 6 ± 0.5 | 73.0 ± 1.5 | 1.5          | 5           |  |
|        |           |         | 52.4 ± 1.5 | 1.2          |             |  |
| MFR200 | MFR3WS    | 6 ± 0.5 | 73.0 ± 1.5 | 1.5          | 10          |  |
|        |           |         | 52.4 ± 1.5 | 1.2          |             |  |

**TAPE ON REEL PACKING**

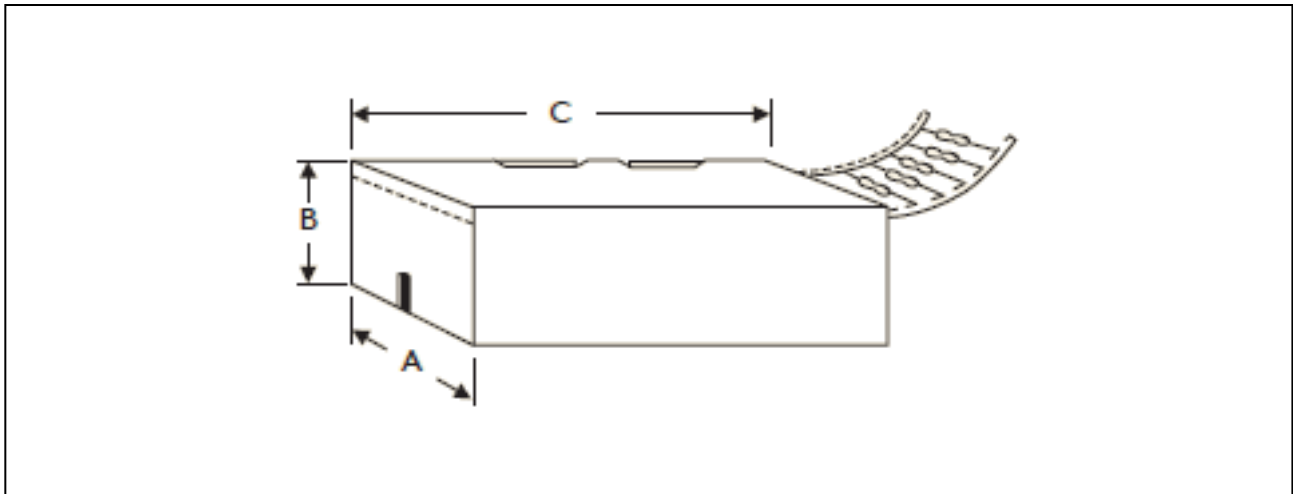


TYPE

Unit: mm/piece

| Normal | Miniature | Across Flange(A) | B    | Quantity Per Reel |
|--------|-----------|------------------|------|-------------------|
| MFR-12 | MFR25S    | 66.5             | 75.5 | 5,000             |
| MFR-25 | MFR50S    | 66.5             | 75.5 | 5,000             |
| MFR-50 | MFR1WS    | 66.5             | 75.5 | 2,500             |
| MFR100 | MFR2WS    | 87               | 96   | 2,000             |
| MFR200 | MFR3WS    | 87               | 96   | 1,000             |

**TAPE ON BOX PACKING**



| TYPE   |           | DIMENSIONS |     |     | Unit: mm/piece   |
|--------|-----------|------------|-----|-----|------------------|
| Normal | Miniature | A          | B   | C   | Quantity Per Box |
| MFR-12 | MFR25S    | 48         | 102 | 255 | 5,000            |
| MFR-12 | MFR25S    | 81         | 70  | 260 | 5,000            |
| MFR-25 | MFR50S    | 48         | 102 | 255 | 5,000            |
| MFR-25 | MFR50S    | 81         | 104 | 260 | 5,000            |
| MFR-50 | MFR1WS    | 73         | 45  | 258 | 1,000            |
| MFR100 | MFR2WS    | 81         | 91  | 260 | 1,000            |
| MFR100 | MFR2WS    | 103        | 78  | 260 | 1,000            |
| MFR200 | MFR3WS    | 81         | 91  | 260 | 1,000            |
| MFR200 | MFR3WS    | 103        | 94  | 260 | 1,000            |

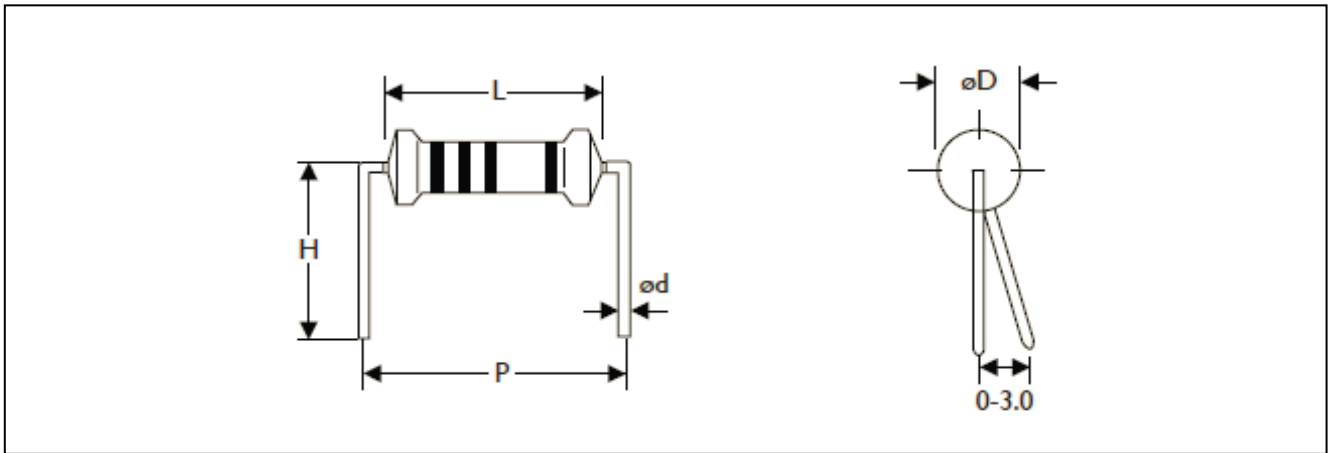
**BULK PACKING**

| Normal | Miniature | Piece/Per Inner Box | Bag/Per Inner Box | Piece Per Bag |
|--------|-----------|---------------------|-------------------|---------------|
| MFR-12 | MFR25S    | 10,000              | 10                | 1,000         |
| MFR-25 | MFR50S    | 10,000              | 10                | 1,000         |
| MFR-50 | MFR1WS    | 5,000               | 5                 | 1,000         |
| MFR100 | MFR2WS    | 2,000               | 4                 | 500           |
| MFR200 | MFR3WS    | 1,000               | 2                 | 500           |



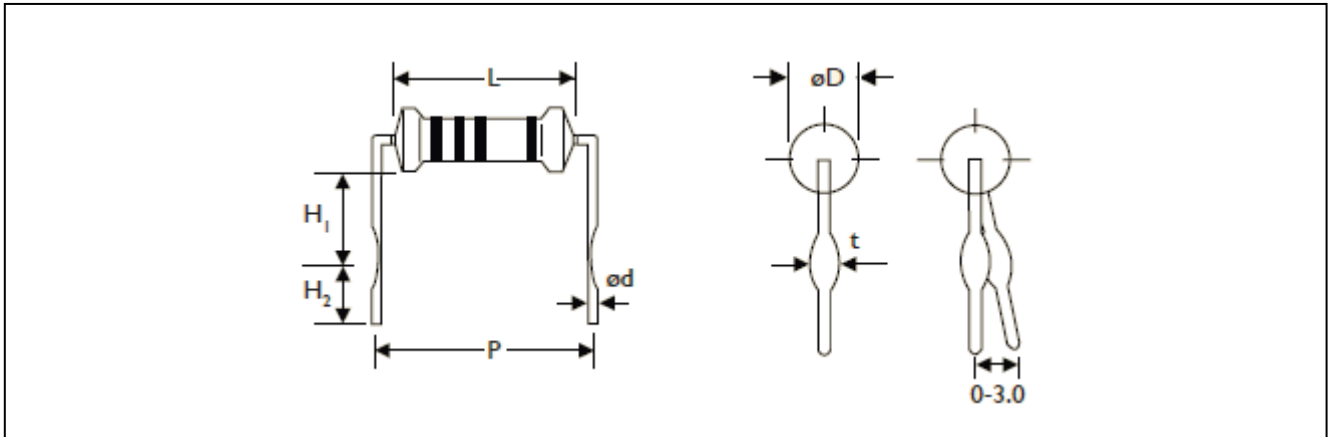
**FORMING**

**M TYPE**



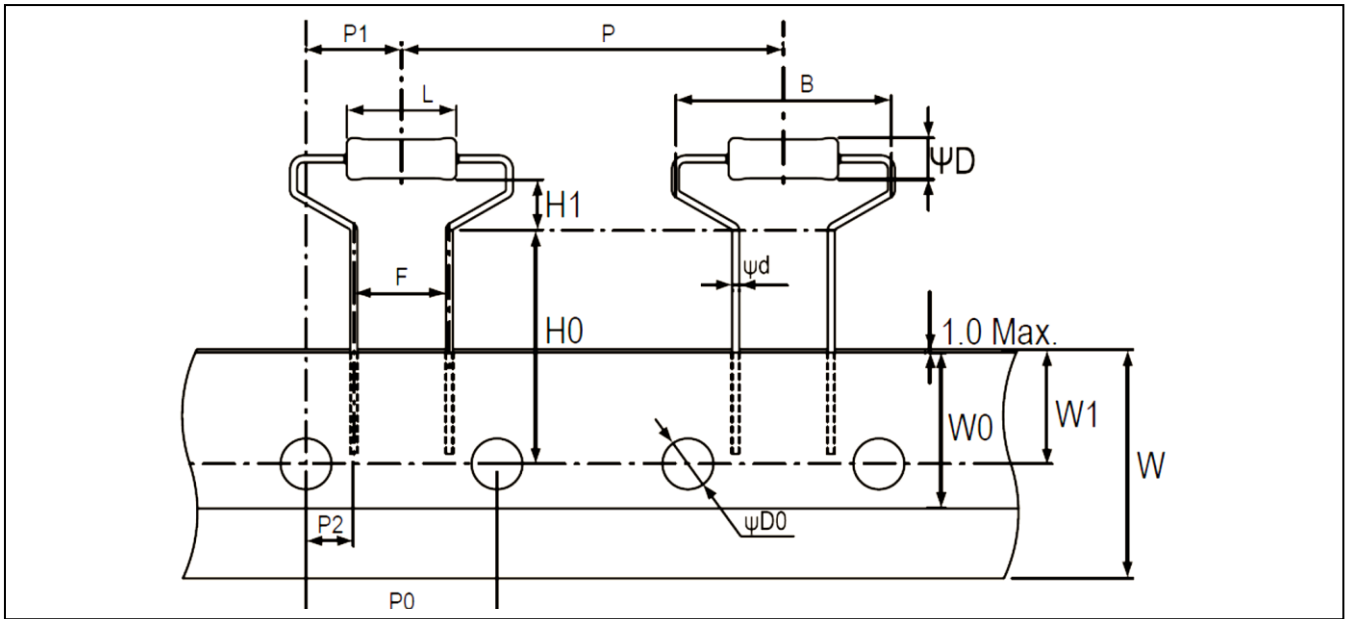
| TYPE   |           | DIMENSIONS |           |             |          |          | Unit: mm |
|--------|-----------|------------|-----------|-------------|----------|----------|----------|
| Normal | Miniature | L          | ψD        | ψd          | P        | H        |          |
| MFR-12 | MFR25S    | 3.4 ± 0.3  | 1.9 ± 0.2 | 0.45 ± 0.05 | 6.0 ± 1  | 10.0 ± 1 |          |
| MFR-25 | MFR50S    | 6.3 ± 0.5  | 2.4 ± 0.2 | 0.55 ± 0.05 | 10.0 ± 1 | 10.0 ± 1 |          |
| MFR-50 | MFR1WS    | 9.0 ± 0.5  | 3.3 ± 0.3 | 0.55 ± 0.05 | 12.5 ± 1 | 10.0 ± 1 |          |
| MFR100 | MFR2WS    | 11.5 ± 1.0 | 4.5 ± 0.5 | 0.8 ± 0.05  | 15.0 ± 1 | 12.5 ± 1 |          |
| MFR200 | MFR3WS    | 15.5 ± 1.0 | 5.0 ± 0.5 | 0.8 ± 0.05  | 20.0 ± 1 | 15.0 ± 1 |          |

**MB TYPE**



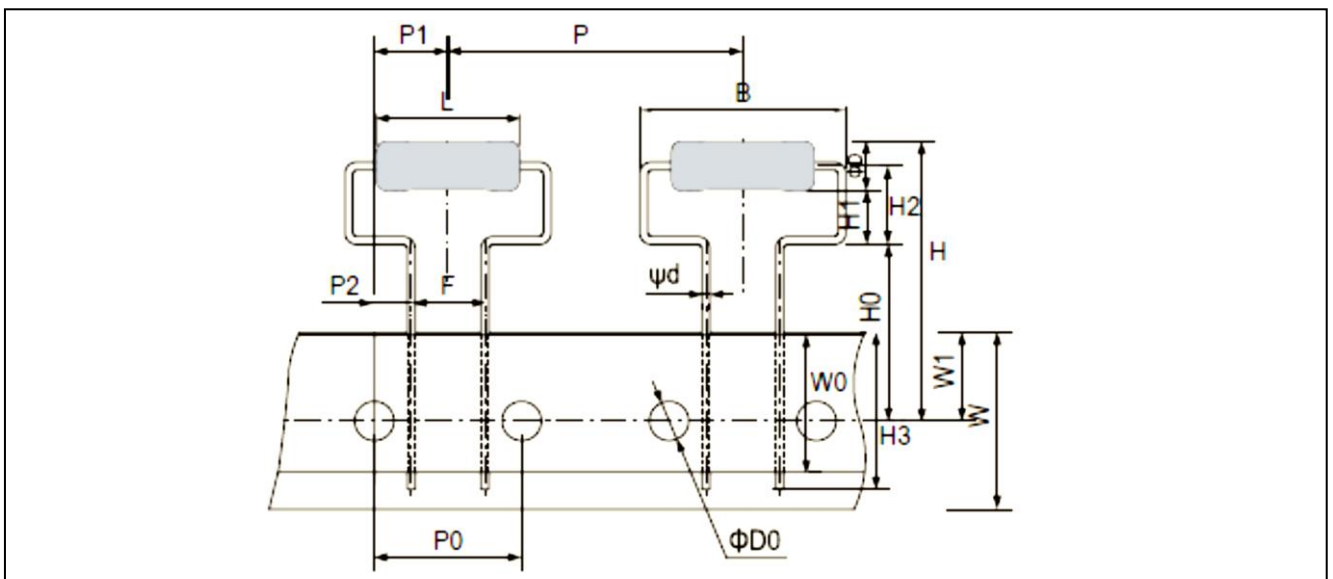
| TYPE   |           | DIMENSIONS     |               |                 |              |              |             |               | Unit: mm |
|--------|-----------|----------------|---------------|-----------------|--------------|--------------|-------------|---------------|----------|
| Normal | Miniature | L              | $\psi D$      | $\psi d$        | P            | H1           | H2          | t             |          |
| MFR-25 | MFR50S    | $6.3 \pm 0.5$  | $2.4 \pm 0.2$ | $0.55 \pm 0.05$ | $10.0 \pm 1$ | $6.0 \pm 1$  | $5.0 \pm 1$ | $1.2 \pm 0.2$ |          |
| MFR-50 | -         | $9.0 \pm 0.5$  | $3.3 \pm 0.3$ | $0.55 \pm 0.05$ | $12.5 \pm 1$ | $6.0 \pm 1$  | $5.0 \pm 1$ | $1.2 \pm 0.2$ |          |
| -      | MFR1WS    | $9.0 \pm 0.5$  | $3.3 \pm 0.3$ | $0.8 \pm 0.05$  | $12.5 \pm 1$ | $6.0 \pm 1$  | $5.0 \pm 1$ | $1.4 \pm 0.2$ |          |
| MFR100 | MFR2WS    | $11.5 \pm 1.0$ | $4.5 \pm 0.5$ | $0.8 \pm 0.05$  | $15.0 \pm 1$ | $6.0 \pm 1$  | $5.0 \pm 1$ | $1.4 \pm 0.2$ |          |
| MFR200 | MFR3WS    | $15.5 \pm 1.0$ | $5.0 \pm 0.5$ | $0.8 \pm 0.05$  | $20.0 \pm 1$ | $10.0 \pm 1$ | $5.0 \pm 1$ | $1.4 \pm 0.2$ |          |

**MHA TYPE**



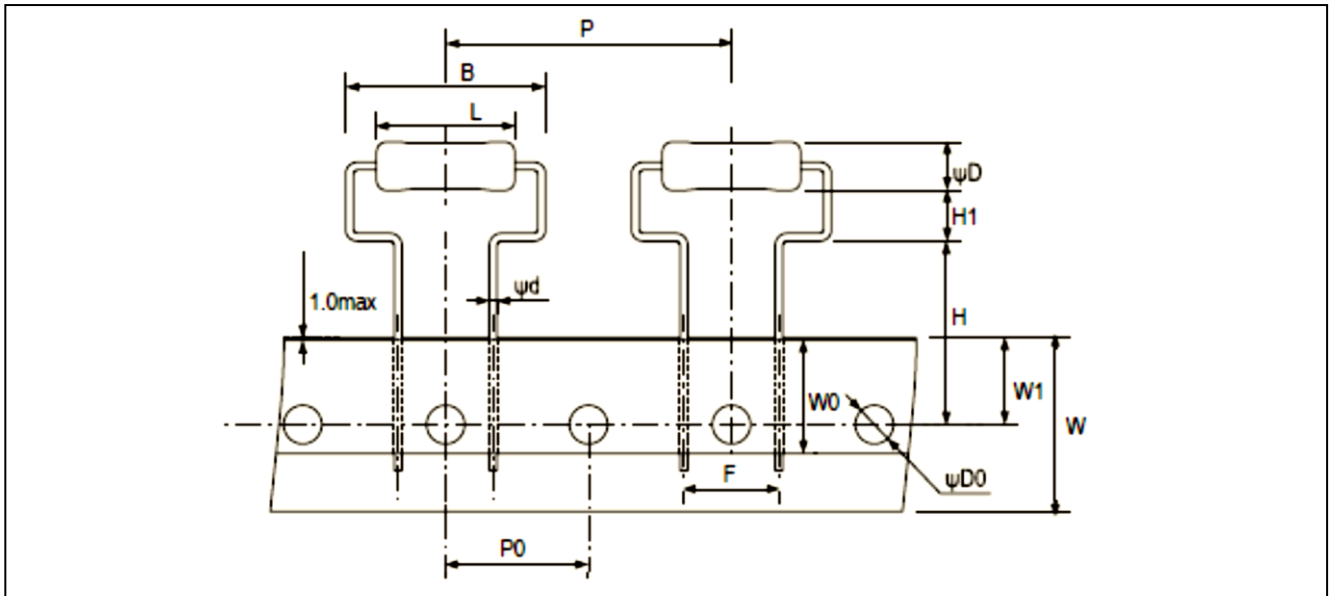
| TYPE          |                  | DIMENSIONS |                            |                            |          |           |           |                             |           | Unit: mm |
|---------------|------------------|------------|----------------------------|----------------------------|----------|-----------|-----------|-----------------------------|-----------|----------|
| <b>Normal</b> | <b>Miniature</b> | <b>L</b>   | <b><math>\psi D</math></b> | <b><math>\psi d</math></b> | <b>B</b> | <b>H0</b> | <b>H1</b> | <b>P</b>                    | <b>P0</b> |          |
|               |                  | 9.0±0.5    | 3.3±0.3                    | 0.55±0.05                  | 17.5Max  | 19.0±1.0  | 4.0±1.0   | 30.0±1.0                    | 15.0±0.3  |          |
| MFR-50        | MFR1WS           | <b>P1</b>  | <b>P2</b>                  | <b>F</b>                   | <b>W</b> | <b>W0</b> | <b>W1</b> | <b><math>\psi D0</math></b> |           |          |
|               |                  | 7.5±1.0    | 3.75±0.5                   | 7.5±0.5                    | 18.0±0.5 | 5.0Min    | 9.0±0.5   | 4.0±0.2                     |           |          |

**MHB TYPE**



| TYPE          |                  | DIMENSIONS |                            |                            |           |          |           |           |           |                             | Unit: mm |
|---------------|------------------|------------|----------------------------|----------------------------|-----------|----------|-----------|-----------|-----------|-----------------------------|----------|
| <b>Normal</b> | <b>Miniature</b> | <b>L</b>   | <b><math>\psi D</math></b> | <b><math>\psi d</math></b> | <b>B</b>  | <b>H</b> | <b>H0</b> | <b>H1</b> | <b>H2</b> | <b>H3</b>                   |          |
|               |                  | 15.5±1.0   | 5.0±0.5                    | 0.8±0.05                   | 21.0Max.  | 30Max.   | 18.0±1.0  | 5.5(Ref.) | 8.0±1.5   | 16Max.                      |          |
| MFR200        | MFR3WS           | <b>P</b>   | <b>P0</b>                  | <b>P1</b>                  | <b>P2</b> | <b>F</b> | <b>W</b>  | <b>W0</b> | <b>W1</b> | <b><math>\psi D0</math></b> |          |
|               |                  | 30.0±1.0   | 15.0±0.3                   | 7.5±1.0                    | 3.75±0.8  | 7.5±0.5  | 18.0±0.5  | 5.0Min.   | 9.0±0.5   | 4.0±0.3                     |          |

**MHC TYPE**



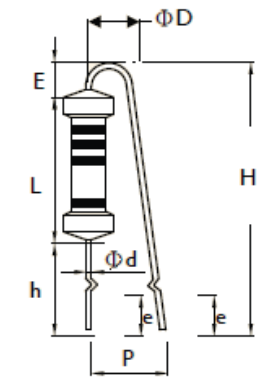
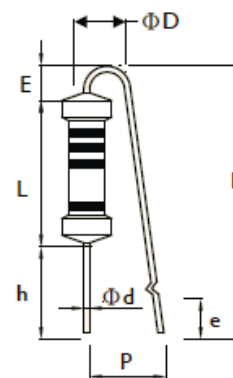
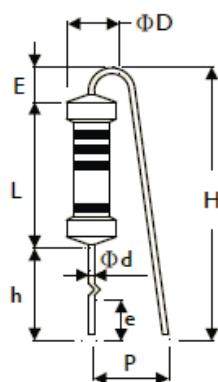
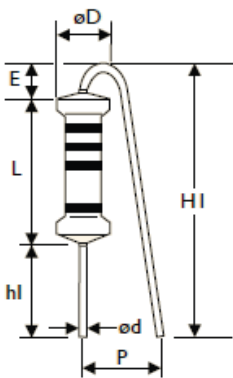
| TYPE          |                  | DIMENSIONS |          |          |          |           |          |          |          | Unit: mm |
|---------------|------------------|------------|----------|----------|----------|-----------|----------|----------|----------|----------|
| <b>Normal</b> | <b>Miniature</b> | L          | $\psi D$ | $\psi d$ | B        | H         | HI       | P        | P0       |          |
|               |                  | 15.5±1.0   | 5.0±0.5  | 0.8±0.05 | 21.0Max. | 19.0±1.0  | 5.25±1.0 | 30.0±1.0 | 15.0±0.3 |          |
| MFR200        | MFR3WS           | F          | W        | W0       | W1       | $\psi D0$ |          |          |          |          |
|               |                  | 10.0±0.5   | 18.0±0.5 | 5.0Min.  | 9.0±0.5  | 4.0±0.2   |          |          |          |          |

**F TYPE**

**FK TYPE**

**FFK TYPE**

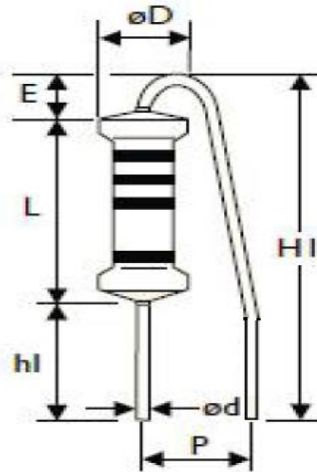
**FKK TYPE**



| TYPE          |                  | DIMENSIONS |           |             |     |     |        |         |           |        |       | Unit: mm |
|---------------|------------------|------------|-----------|-------------|-----|-----|--------|---------|-----------|--------|-------|----------|
| <b>Normal</b> | <b>Miniature</b> | L          | $\psi D$  | $\psi d$    | P   | h   | H Max. | h1      | HI        | E Max. | e     |          |
| MFR-25        | MFR50S           | 6.3 ± 0.5  | 2.4 ± 0.2 | 0.55 ± 0.05 | 6±1 | -   | -      | 5.5±0.5 | 13.5±0.5  | 3.5    | -     |          |
| MFR-50        | MFR1WS           | 9.0±0.5    | 3.3±0.3   | 0.55±0.05   | 6±1 | 8±1 | 22     | 5±1     | 18.5 Max. | 3.5    | 3.5±1 |          |
| MFR100        | MFR2WS           | 11.5±1     | 4.5±0.5   | 0.8±0.05    | 6±1 | 8±1 | 24     | 5±1     | 20 Max.   | 3.5    | 3.5±1 |          |
| MFR200        | MFR3WS           | 15.5±1     | 5.0±0.5   | 0.8±0.05    | 8±1 | 8±1 | 28     | 5 ± 1   | 25 Max.   | 3.5    | 3.5±1 |          |

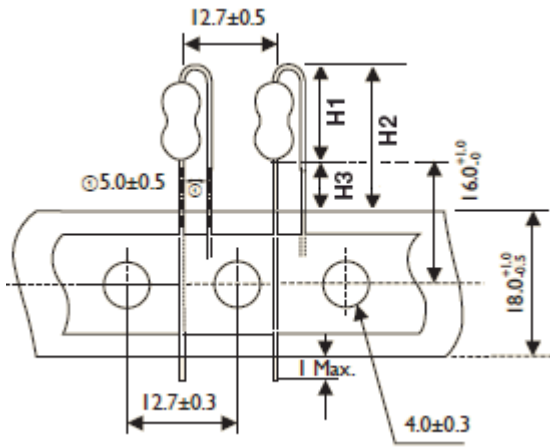
Will EOL F forming code to -25&50S on Feb.28,2023

**FB- TYPE (for -25&50S)**



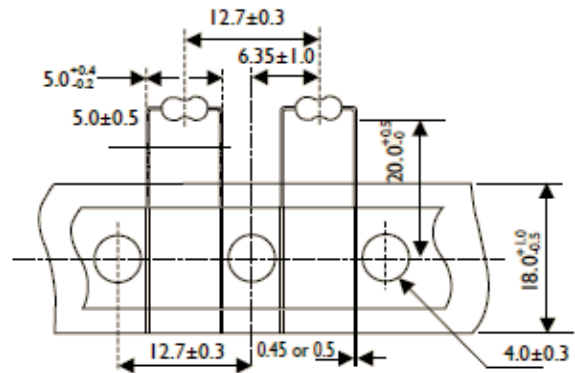
| TYPE   |           | DIMENSIONS    |               |                 |           |               |                |        | Unit: mm |
|--------|-----------|---------------|---------------|-----------------|-----------|---------------|----------------|--------|----------|
| Normal | Miniature | L             | $\psi D$      | $\psi d$        | P         | hI            | HI             | E Max. |          |
| MFR-25 | MFR50S    | $6.3 \pm 0.5$ | $2.4 \pm 0.2$ | $0.55 \pm 0.05$ | $6 \pm 1$ | $5.5 \pm 0.5$ | $13.5 \pm 0.5$ | 3.5    |          |

**FT TYPE (Taping Pack)**



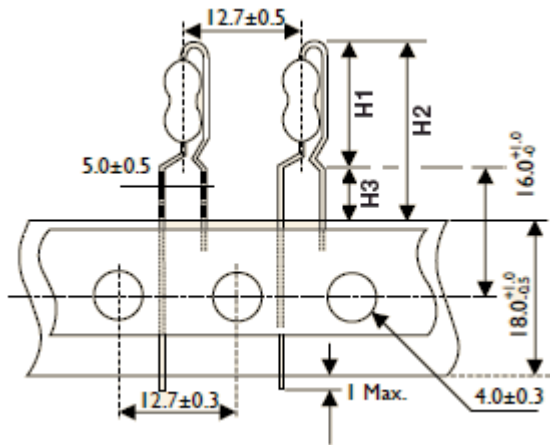
**MT TYPE (Taping Pack)**

Rated Watts : 1/6W,1/4WS

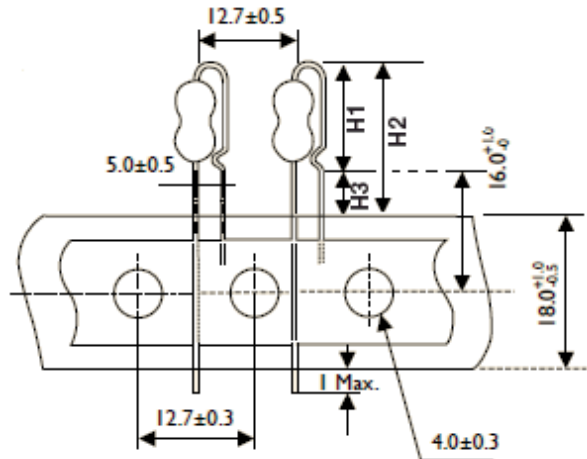


| TYPE   |           | DIMENSIONS |         |         | Unit: mm |
|--------|-----------|------------|---------|---------|----------|
| Normal | Miniature | H1 Max.    | H2 Max. | H3 Max. |          |
| MFR-25 | MFR50S    | 10         | 18.5    | 8.5     |          |
| MFR-50 | MFR1WS    | 13         | 21.5    | 8.5     |          |
| MFR100 | MFR2WS    | 16         | 24.5    | 8.5     |          |

**PN TYPE (Taping Pack)**



**AV TYPE (Taping Pack)**



| TYPE   |           | DIMENSIONS |         |         | Unit: mm |
|--------|-----------|------------|---------|---------|----------|
| Normal | Miniature | H1 Max.    | H2 Max. | H3 Max. |          |
| MFR-25 | MFR50S    | 13         | 21.5    | 8.5     |          |
| MFR-50 | MFR1WS    | 17         | 25.5    | 8.5     |          |
| MFR100 | MFR2WS    | 19         | 27.5    | 8.5     |          |

| TYPE   |           | DIMENSIONS |         |         | Unit: mm |
|--------|-----------|------------|---------|---------|----------|
| Normal | Miniature | H1 Max.    | H2 Max. | H3 Max. |          |
| MFR-25 | MFR50S    | 11.5       | 20      | 8.5     |          |
| MFR-50 | MFR1WS    | 14.5       | 23      | 8.5     |          |
| MFR100 | MFR2WS    | 17.5       | 26      | 8.5     |          |

**MARKING**



| COLOR  | 1st BAND | 2nd BAND | 3rd BAND | MULTIPLIER | TOLERANCE     |
|--------|----------|----------|----------|------------|---------------|
| BLACK  | 0        | 0        | 0        | 1Ω         |               |
| BROWN  | 1        | 1        | 1        | 10Ω        | ± 1% ( F )    |
| RED    | 2        | 2        | 2        | 100Ω       | ± 2% ( G )    |
| ORANGE | 3        | 3        | 3        | 1KΩ        |               |
| YELLOW | 4        | 4        | 4        | 10KΩ       |               |
| GREEN  | 5        | 5        | 5        | 100K       | ± 0.5 % ( D ) |
| BLUE   | 6        | 6        | 6        | 1MΩ        |               |
| VIOLET | 7        | 7        | 7        | 10MΩ       |               |
| GREY   | 8        | 8        | 8        | 0.001Ω     |               |
| WHITE  | 9        | 9        | 9        | 0.0001Ω    |               |
| GOLD   |          |          |          | 0.1Ω       | ± 5 % ( J )   |
| SILVER |          |          |          | 0.01Ω      |               |



**REVISION HISTORY**

| REVISION  | DATE         | CHANGE NOTIFICATION | DESCRIPTION  |
|-----------|--------------|---------------------|--|
| Version 3 | Sep.6, 2023  | -                   | - Updated legal disclaimer and footer versions numbers                                   |
| Version 2 | Aug.31, 2022 | -                   | - Add FB- forming code to -25&50S<br>- Will EOL F forming code to -25&50S on Feb.28,2023 |
| Version 1 | Sep.28, 2021 | -                   | - Add F TYPE for -25&50S power   |
| Version 0 | Aug.2, 2021  | -                   | - First issue of this specification  |

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