

# 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



**YAGEO**





## 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

## 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.

## PART NUMBER

| <u>MFR</u> | <u>200</u> | <u>F</u> | <u>T</u> | <u>F</u> | <u>73-</u> | <u>100R</u> |
|------------|------------|----------|----------|----------|------------|-------------|
| (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 = $\pm 0.5\%$ | F = $\pm 1\%$ | G = $\pm 2\%$ |
| J = $\pm 5\%$   |               |               |

### (4) PACKAGING

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

### (5) TEMPERATURE COEFFICIENT OF RESISTANCE

|                               |                                |                   |
|-------------------------------|--------------------------------|-------------------|
| E= $\pm 50$ ppm/ $^{\circ}$ C | F= $\pm 100$ ppm/ $^{\circ}$ 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, $\psi d$ 0.4 $\pm$ 0.02mm        |                              |
| 52B=52.4mm, $\psi d$ 0.45 $\pm$ 0.02mm       |                              |
| 52C=52.4mm, $\psi d$ 0.5 $\pm$ 0.02mm        |                              |
| 52G=52.4mm, $\psi d$ $\geq$ 0.6mm            |                              |
| 52H=52.4mm , non-painting on soldering spots |                              |

### (7) RESISTANCE VALUE

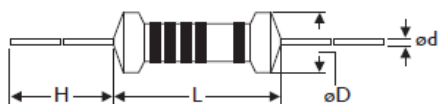
E24 & E96 & E192 Series

Example:

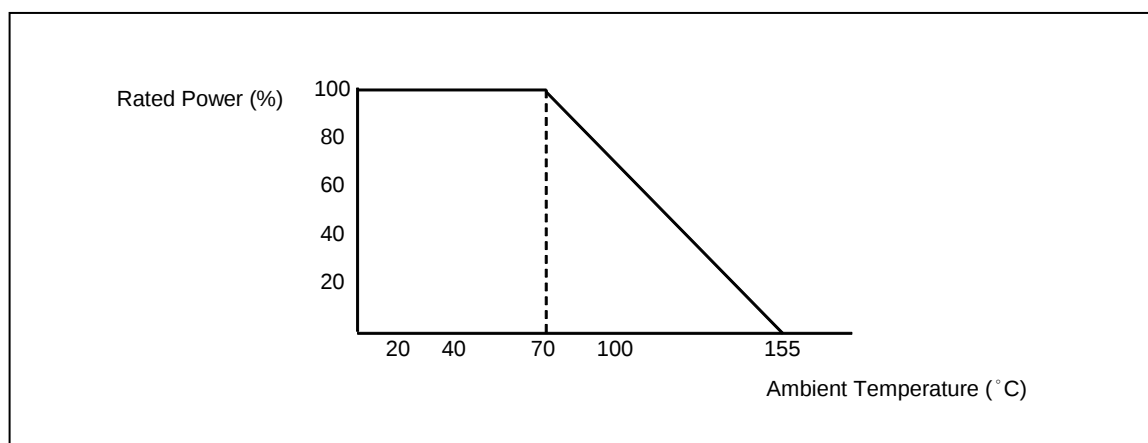
100R = 100 $\Omega$ , 10K = 10,000 $\Omega$ , 1M = 1,000,000 $\Omega$

**DIMENSIONS**

Unit: mm



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

**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 REQUIREMENTS**

| 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)             | ±0.25%+0.05Ω                              |
| 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.                                                        | >10,000MΩ                                 |
| Solderability                 | IEC 60115-1 4.17 | 245±5°C for 3±0.5 Sec.                                                        | 95% Min. coverage                         |
| Solvent Resistance of Marking | IEC 60115-1 4.30 | IPA for 5±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                | ≥2.5Kg(24.5N)                             |
| Periodic-pulse Overload       | IEC 60115-1 4.39 | 4 times RCWV 10,000 cycles (1 Sec. on, 25 Sec.off)                            | ±1.0%+0.05Ω                               |
| Damp Heat Steady State        | IEC 60115-1 4.24 | 40±2°C,90-95% RH for 56 days, loaded with 0.1 times RCWV                      | ±1.5%+0.05Ω                               |
| Endurance at 70°C             | IEC 60115-1 4.25 | 70±2°C at RCWV(or Umax., whichever less) for 1,000 Hr.(1.5 Hr.on,0.5 Hr. off) | ±1.5%+0.05Ω                               |
| Temperature Cycling           | IEC 60115-1 4.19 | → -55°C → Room Temp. → +155°C Room Temp.(5 cycles)                            | ±0.75%+0.05Ω                              |
| Resistance to Soldering Heat  | IEC 60115-1 4.18 | 260±3°C for 10±1 Sec., immersed to a point 3±0.5mm from the body              | ±0.25%+0.05Ω                              |

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:

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

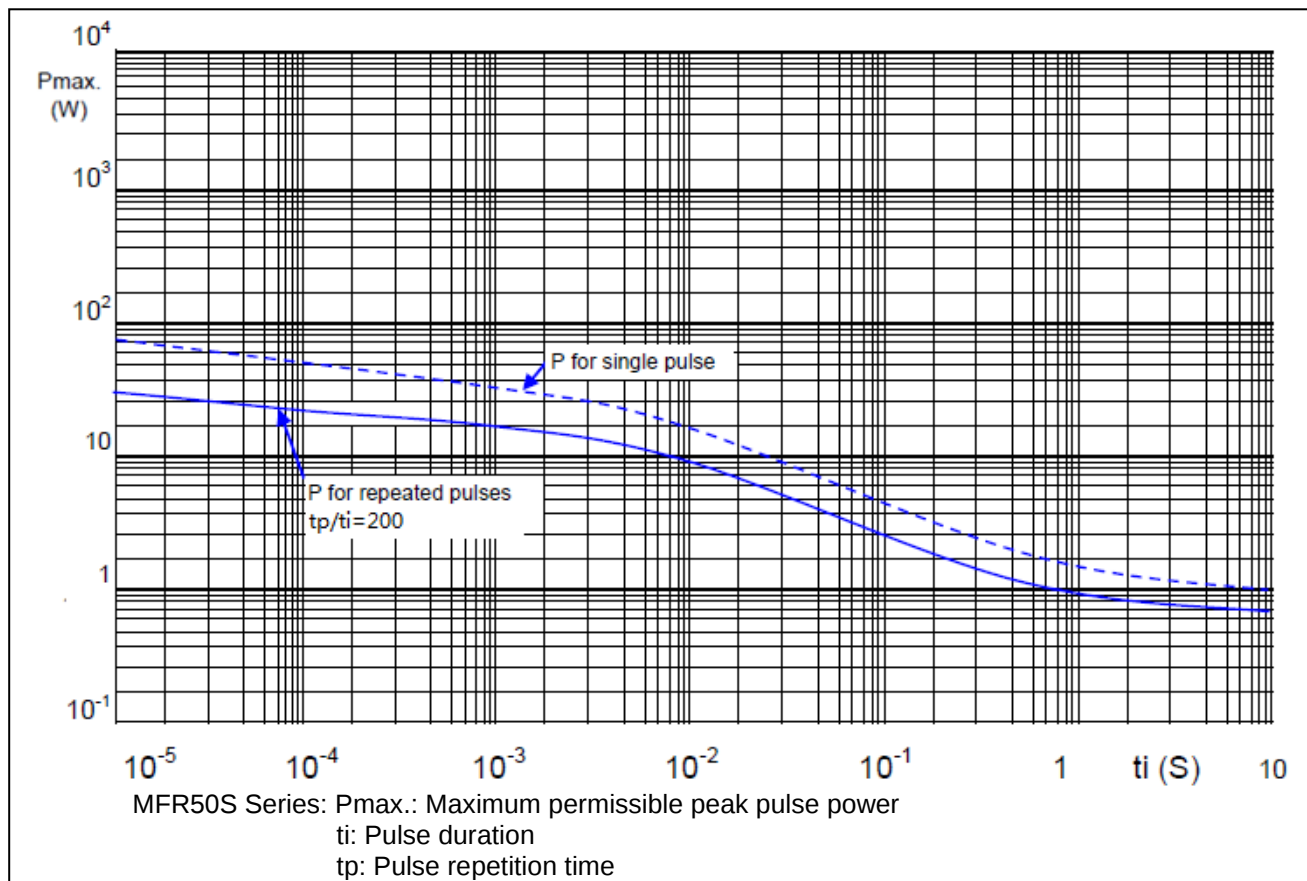
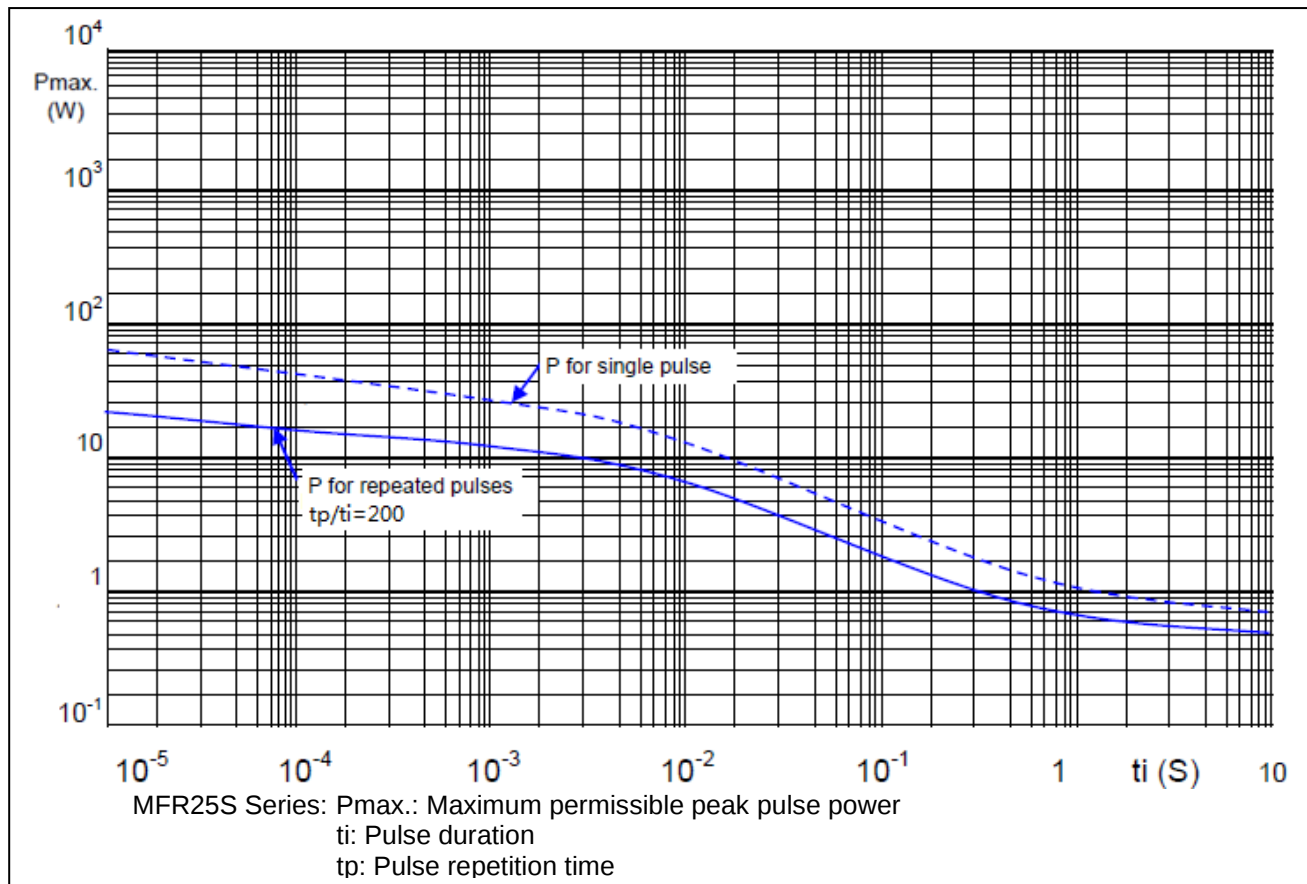
or max. working voltage whichever is less

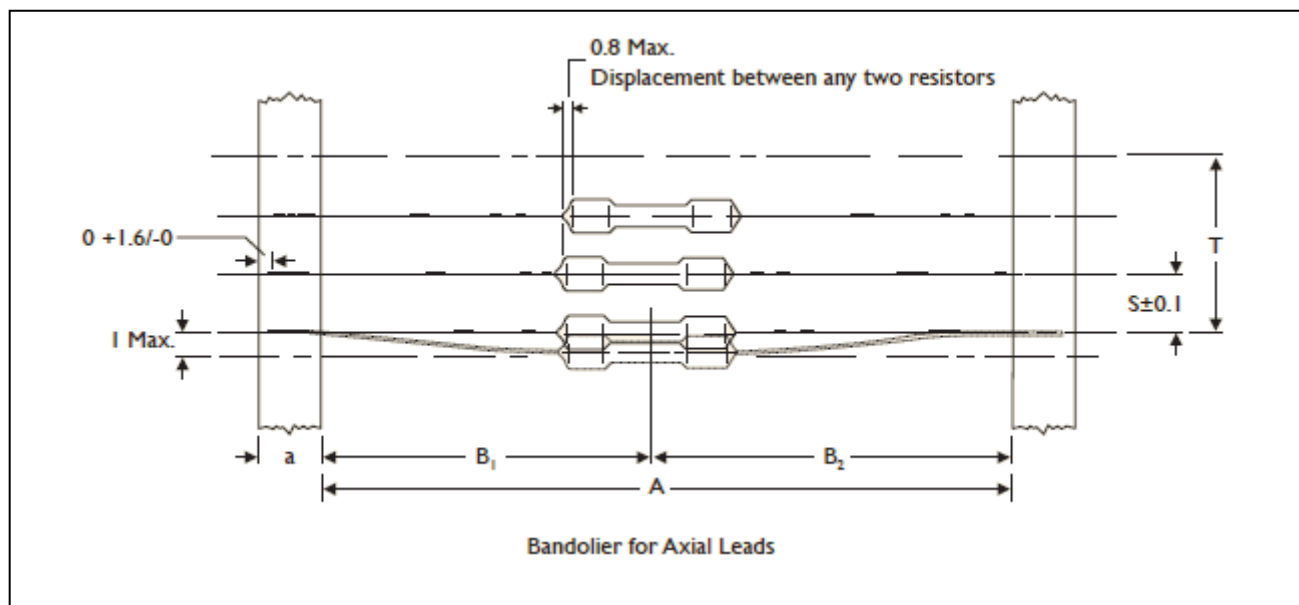
Where

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

P=Rated power (W)

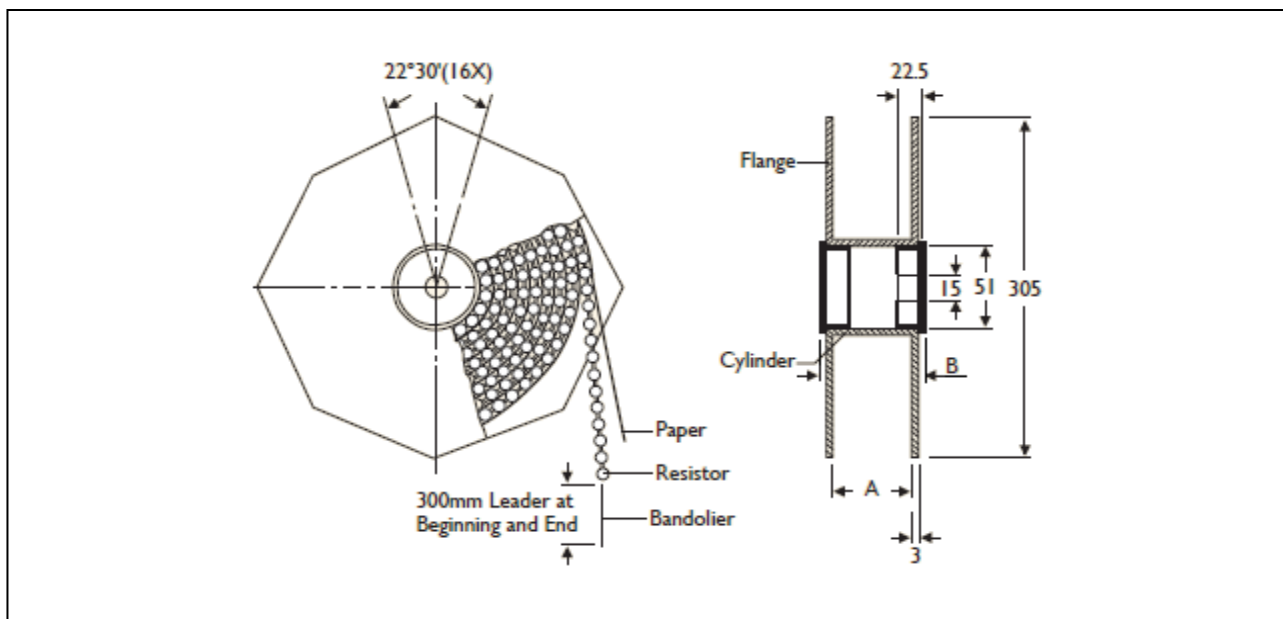
R=Resistance value (Ω)

**PULSE DIAGRAMS**

**AXIAL / REEL TAPE SPECIFICATION**

Unit: mm

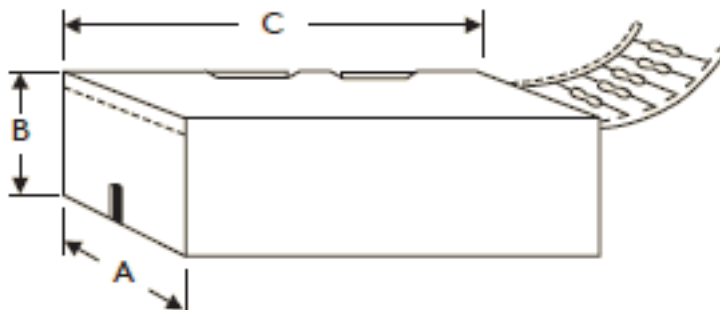
| Normal | Miniature | a       | A          | B1-B2 (Max.) | S (spacing) | T (max. deviation of spacing)                |
|--------|-----------|---------|------------|--------------|-------------|----------------------------------------------|
| MFR-12 | MFR25S    | 6 ± 0.5 | 52.4 ± 1.5 | 1.2          | 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

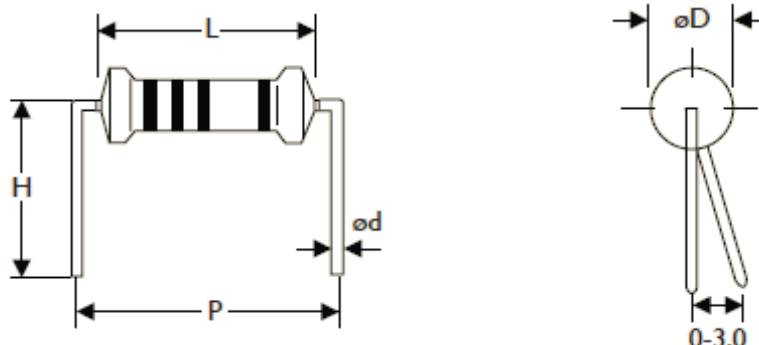
| Normal | Miniature | Across Flange(A) | B    | Quantity Per Reel |
|--------|-----------|------------------|------|-------------------|
| MFR-12 | MFR25S    | 66.5             | 75.5 | 5,000             |
| MFR-25 | MFR50S    | 66.5             | 75.5 | 5,000             |
| MFR-50 | MFR1WS    | 66.5             | 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            |

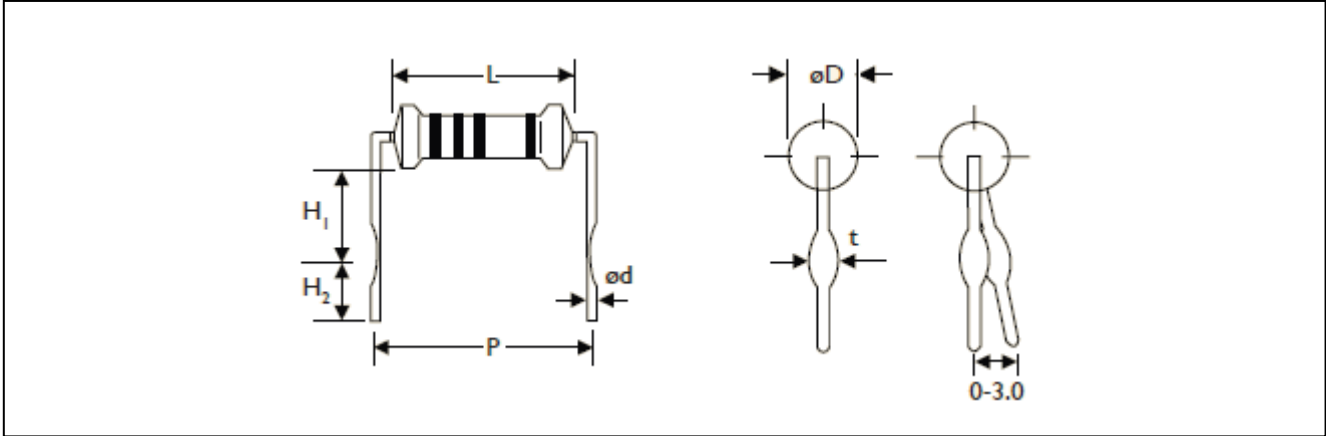
**BULK PACKING**

| 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**

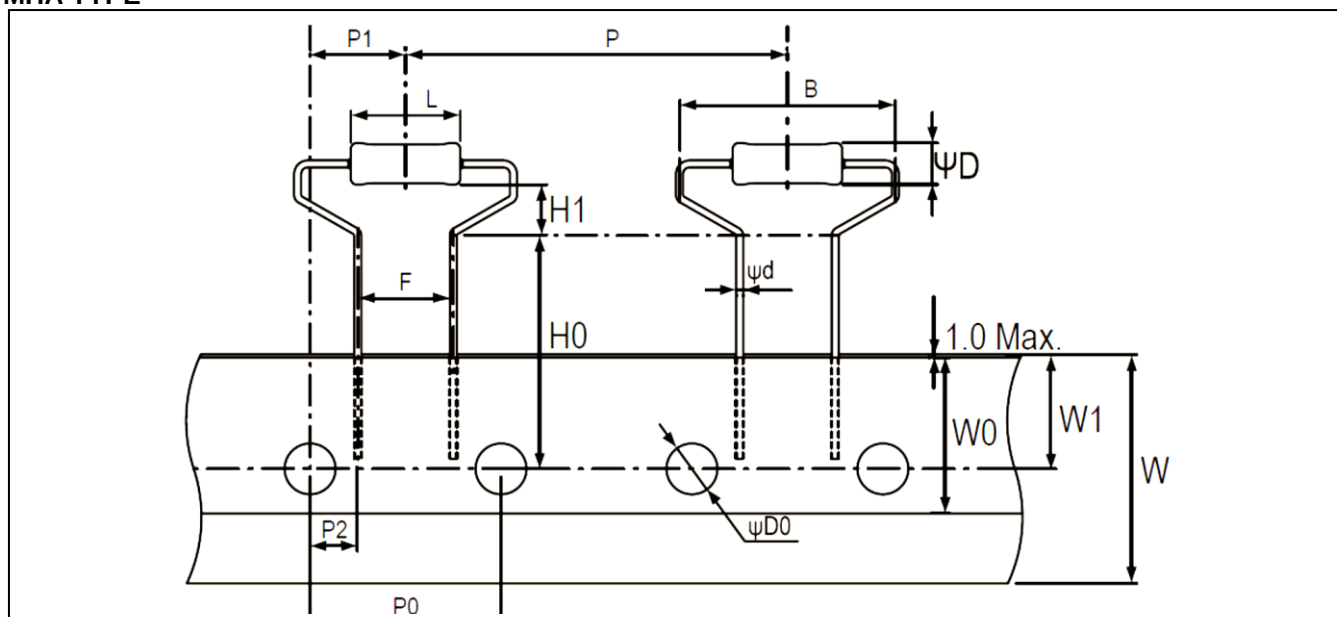
| TYPE   |           | DIMENSIONS     |               |                 |              |              | Unit: mm |
|--------|-----------|----------------|---------------|-----------------|--------------|--------------|----------|
| Normal | Miniature | L              | $\psi D$      | $\psi d$      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

MB TYPE



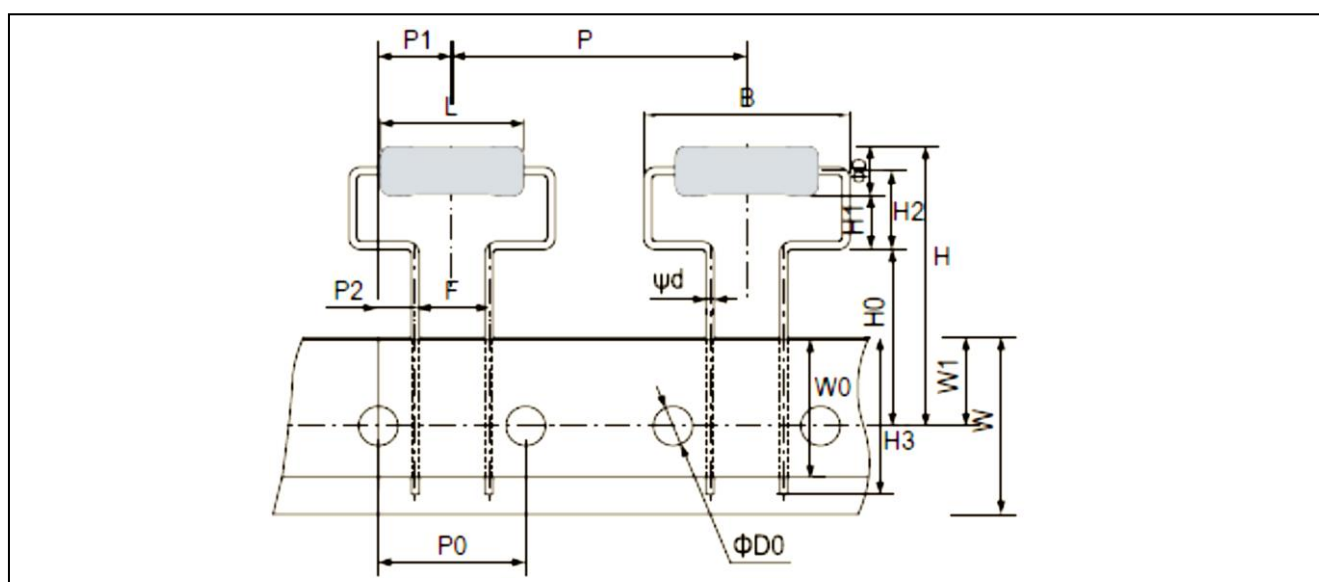
| TYPE   |           | DIMENSIONS |           |             |          |          | Unit: mm |           |
|--------|-----------|------------|-----------|-------------|----------|----------|----------|-----------|
| Normal | Miniature | L          | ψD        | ψd          | P        | H1       | H2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

## MHA TYPE



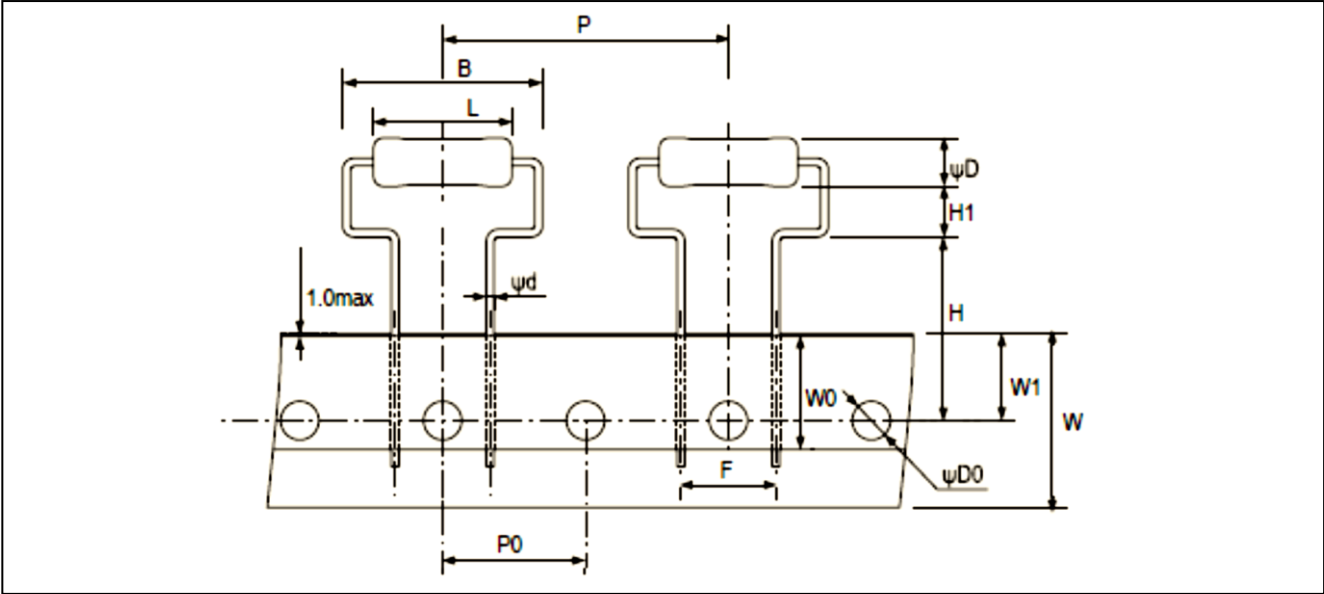
| TYPE   |           | DIMENSIONS |          |           |          |          |         |           |          | Unit: mm |
|--------|-----------|------------|----------|-----------|----------|----------|---------|-----------|----------|----------|
| Normal | Miniature | L          | $\psi D$ | $\psi d$  | B        | H0       | H1      | P         | P0       |          |
|        |           | 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    | P1         | P2       | F         | W        | W0       | W1      | $\psi D0$ |          |          |
|        |           | 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



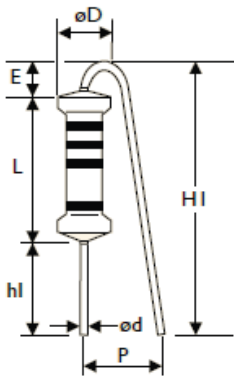
| TYPE   |           | DIMENSIONS |          |          |          |         |          |           |         |           | Unit: mm |
|--------|-----------|------------|----------|----------|----------|---------|----------|-----------|---------|-----------|----------|
| Normal | Miniature | L          | $\psi D$ | $\psi d$ | B        | H       | H0       | H1        | H2      | H3        |          |
|        |           | 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    | P          | P0       | P1       | P2       | F       | W        | W0        | W1      | $\psi D0$ |          |
|        |           | 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

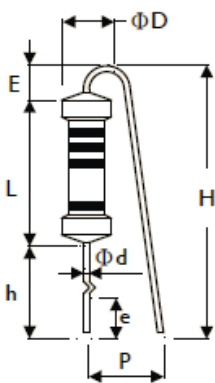


| TYPE   |           | DIMENSIONS |          |          |          |          |          |          |          | Unit: mm |
|--------|-----------|------------|----------|----------|----------|----------|----------|----------|----------|----------|
| Normal | Miniature | L          | ψD       | ψd       | 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       | ψD0      |          |          |          |          |
|        |           | 10.0±0.5   | 18.0±0.5 | 5.0Min.  | 9.0±0.5  | 4.0±0.2  |          |          |          |          |

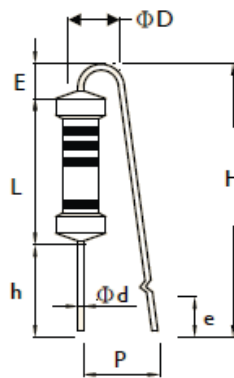
F TYPE



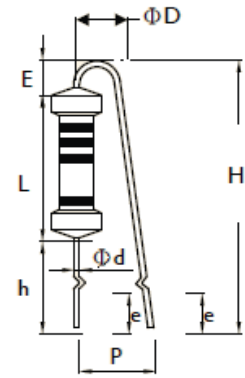
FK TYPE



FFK TYPE



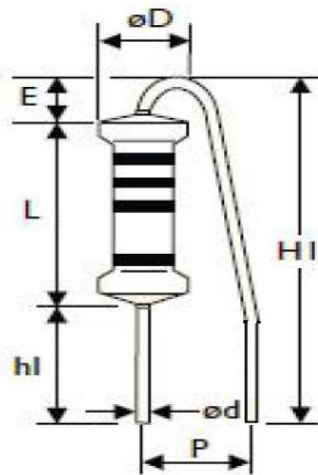
FKK TYPE



| TYPE   |           | DIMENSIONS |           |             |     |     |        |         |           |        |       | Unit: mm |
|--------|-----------|------------|-----------|-------------|-----|-----|--------|---------|-----------|--------|-------|----------|
| Normal | Miniature | L          | ψD        | ψd          | P   | h   | H Max. | hI      | 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 |          |

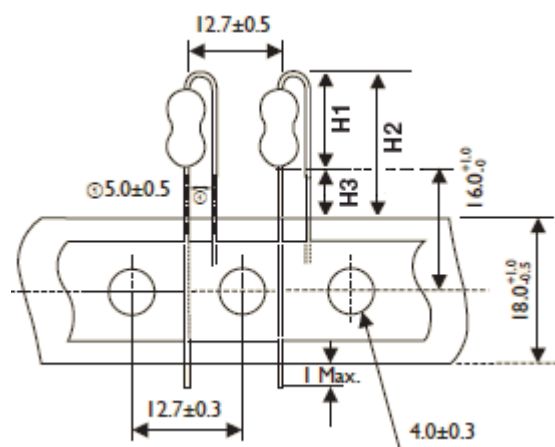
Will EOL F forming code to -25&50S on Feb.28,2023

FB- TYPE (for -25&50S)



| TYPE   |           | DIMENSIONS    |               |                 |           |               |                |           | Unit: mm |
|--------|-----------|---------------|---------------|-----------------|-----------|---------------|----------------|-----------|----------|
| Normal | Miniature | L             | $\psi D$      | $\psi d$        | P         | hI            | HI             | E<br>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)

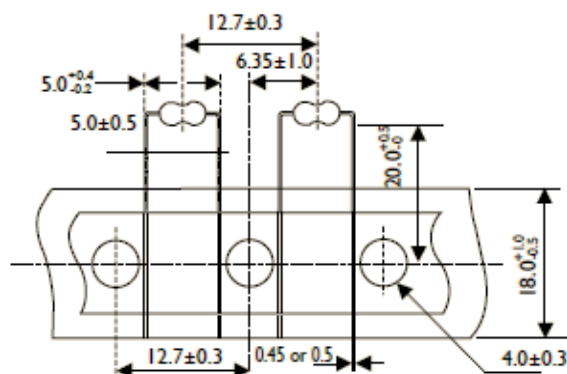


TYPE DIMENSIONS Unit: mm

| Normal | Miniature | H1<br>Max. | H2<br>Max. | H3<br>Max. |
|--------|-----------|------------|------------|------------|
| MFR-25 | MFR50S    | 10         | 18.5       | 8.5        |
| MFR-50 | MFR1WS    | 13         | 21.5       | 8.5        |
| MFR100 | MFR2WS    | 16         | 24.5       | 8.5        |

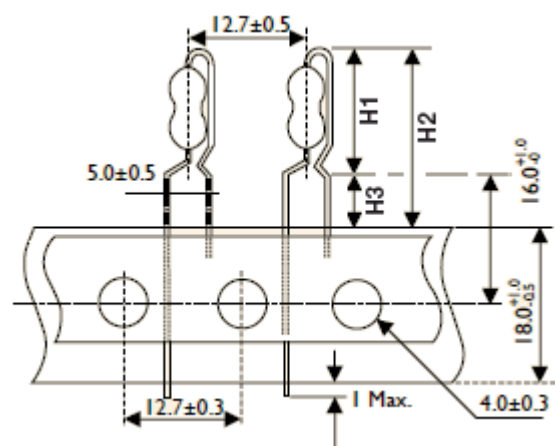
## MT TYPE (Taping Pack)

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



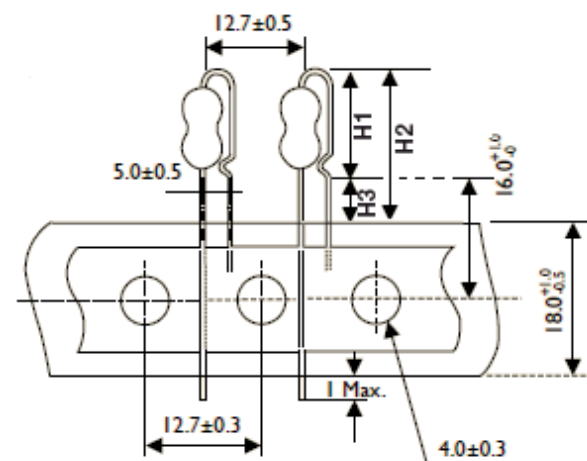
## AV TYPE (Taping Pack)

## PN TYPE (Taping Pack)



TYPE DIMENSIONS Unit: mm

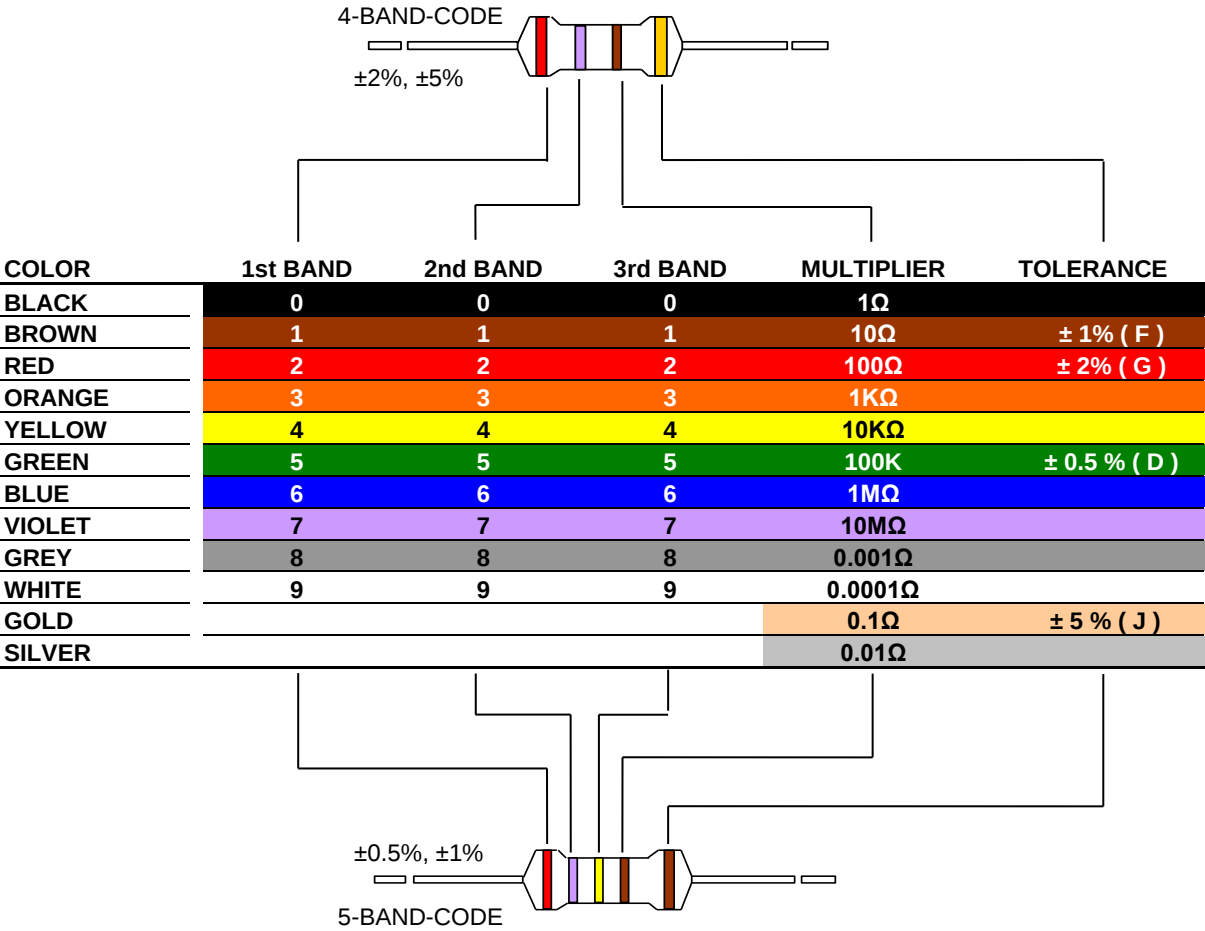
| Normal | Miniature | H1<br>Max. | H2<br>Max. | H3<br>Max. |
|--------|-----------|------------|------------|------------|
| MFR-25 | MFR50S    | 13         | 21.5       | 8.5        |
| MFR-50 | MFR1WS    | 17         | 25.5       | 8.5        |
| MFR100 | MFR2WS    | 19         | 27.5       | 8.5        |



TYPE DIMENSIONS Unit: mm

| Normal | Miniature | H1<br>Max. | H2<br>Max. | H3<br>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



**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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