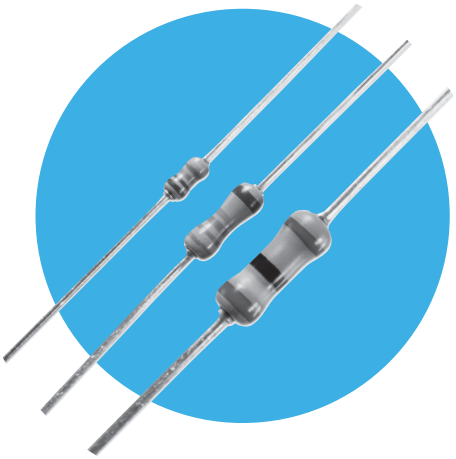
# Resistors

# Metal Film Resistors



**MFR Series**

- Professional grade approved to BSCECC 40101-803 and 019
- Tolerances down to 0.5%
- Temperature coefficient down to 50ppm/°C

All parts are Pb-free and comply with EU Directive 2011/65/EU amended by (EU) 2015/863 (RoHS3)

## Electrical Data

| | | MFR3 | MFR4 | MFR5 |
|---|---|---|---|---|
| Power rating at 70°C | watts | 0.4 | 0.5 | 0.75 |
| Resistance range | ohms | 10R - 1M | 1R0 - 1M | 1R0 - 1M |
| Limiting element voltage | volts | 200 | 350 | 350 |
| TCR | ppm/°C | 50 | 50 | ≤10:150 >10:100 |
| Resistance tolerance | % | 1 | 0.5, 1 | 0.5, 1 |

| CECC 40101 - 019 Requirements | | | FZ | FX | EZ | EX |
|---|---|---|---|---|---|---|
| Power rating at 70°C | watts | | 0.25 | 0.25 | 0.5 | 0.5 |
| Resistance range. | ohms | | 1 to 1M | 1 to 1M | 10 to 1M0 | 10 to 1M |
| Limiting element voltage | volts | | 250 | 250 | 350 | 350 |
| TCR | ppm/°C | | 100<br>5.1 to 9.1 : 200 | 250<br>5.1 to 9.1 : 500 | 100 | 250 |
| Resistance tolerance | % | | 1 | 1 | 1 | 1 |

| CECC 40101 - 803 Requirements | | | BC | BK | CC | CK |
|---|---|---|---|---|---|---|
| Power rating at 70°C | watts | | 0.125 | 0.125 | 0.25 | 0.25 |
| Resistance range. | ohms | | 10 to 1M | 10 to 1M | 10 to 1M | 10 to 1M |
| Limiting element voltage | volts | | 200 | 200 | 250 | 250 |
| TCR | ppm/°C | | 50 | 100 | 50 | 100 |
| Resistance tolerance | % | | 0.5, 1 | 0.5, 1 | 0.5, 1 | 0.5, 1 |

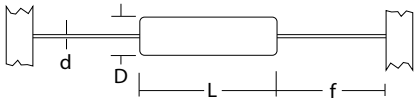
These tables indicate the CECC specification requirements, and these are met or exceeded by the corresponding MFR series products.

| | | | | |
|---|---|---|---|---|
| Standard values | | E24, E96 preferred | | |
| Thermal impedance | °C/watt | 150 | 140 | 112 |
| Ambient temperature range | °C | -55 to 155 | | |
| Product grades available | | commercial | commercial, professional | professional |

## Physical Data

**Dimensions (mm) & Weight (g)**

| Type | | L max | D max | F min | d nom | PCB mount centres | Min bend radius | Wt. nom |
|---|---|---|---|---|---|---|---|---|
| **MFR3** | **Commercial** | 3.7 | 2.0 | 22.4 | 0.45 | 7.6 | 0.5 | 0.1 |
| **MFR4** | **Professional** | 6.2 | 2.5 | 21.0 | 0.6 | 10.2 | 0.6 | 0.3 |
| | **Commercial** | 6.8 | 3.0 | 21.0 | 0.55 | 10.2 | 0.6 | 0.3 |
| **MFR5** | **Professional** | 9.0 | 3.6 | 19.6 | 0.8 | 12.7 | 1.2 | 0.5 |




**General Note**

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BI Technologies IRC Welwyn

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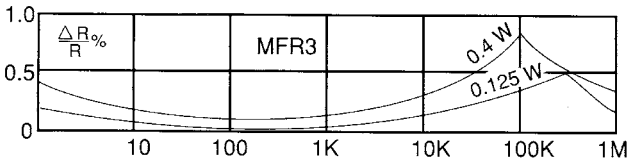
**MFR Series**

# Performance Data - Type MFR 3

| | | | CECC 40101-019* Requirements | Actual Performance Maximum | Actual Performance Typical |
|---|---|---|---|---|---|
| Load at commercial rating : | 1000 hours at 70°C | ΔR % | | 0.8 | See Graph 1 |
| Load at CECC rating : | 1000 hours at 70°C | ΔR % | 2 | 0.5 | See Graph 1 |
| Shelf life : | 12 months at room temperature | ΔR % | Not Specified | 0.1 | 0.07 |
| Derating | | | zero at 155°C | | |
| Short term overload | | ΔR % | 0.5 | 0.25 | 0.03 |
| Climatic | | ΔR % | 2 | 0.5 | 0.2 |
| Climatic category | | | 55/125/56 | | |
| Long term damp heat | | ΔR % | 2 | 0.5 | 0.3 |
| Temperature rapid change | | ΔR % | 0.5 | 0.25 | 0.05 |
| Resistance to solder heat | | ΔR % | 0.5 | 0.25 | 0.02 |
| Vibration and bump | | ΔR % | 0.5 | 0.1 | 0.01 |
| Noise. (in a decade of frequency) | | μV/V | Not specified | 0.1 | 0.07 |
| Insulation resistance | | ohms | >1G | >1G | >1G |
| Voltage proof | | volts | 350 min | 400 min | 400 min |
| Pulse handling | | | Data available upon request | | |

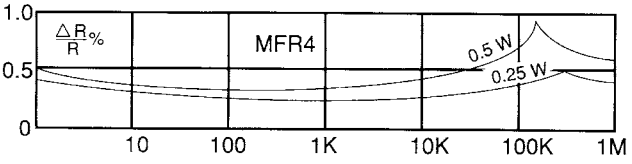
* CECC requirements are included for reference only; CECC release is not available on MFR3




Graph 1 – Load for 1000 hours at 70°C: maximum changes

# Performance Data - Type MFR 4

| | | CECC 40101-019 Requirements | CECC 40101-803 Requirements | Actual Performance Maximum | Actual Performance Typical |
|---|---|---|---|---|---|
| Load at commercial rating : 1000 hours at 70°C | ΔR % | | | 0.8 | See Graph 2 |
| Load at CECC rating : 1000 hours at 70°C | ΔR % | 2 | 1 | 0.5 | See Graph 2 |
| Shelf life : 12 months at room temperature | ΔR % | Not specified | Not Specified | 0.1 | 0.07 |
| Derating | | zero at 155°C | zero at 155°C | | |
| Short term overload | ΔR % | 0.5 | 0.25 | 0.25 | 0.01 |
| Climatic | ΔR % | 2 | 1 | 0.5 | 0.2 |
| Climatic category | | 55/125/56 | 55/125/56 | | |
| Long term damp heat | ΔR % | 2 | 1 | 0.5 | 0.3 |
| Temperature rapid change | ΔR % | 0.5 | 0.25 | 0.25 | 0.04 |
| Resistance to solder heat | ΔR % | 0.5 | 0.25 | 0.25 | 0.07 |
| Vibration and bump | ΔR % | 0.5 | 0.25 | 0.1 | 0.01 |
| Noise. (in a decade of frequency) | μV/V | Not Specified | Not Specified | 0.1 | 0.1 |
| Insulation resistance | ohms | >1G | >1G | >1G | >1G |
| Voltage proof | volts | 500 min | 400 min | 500 min | 500 min |
| Pulse handling | | Data available upon request | | | |




Graph 2 – Load for 1000 hours at 70°C: maximum changes

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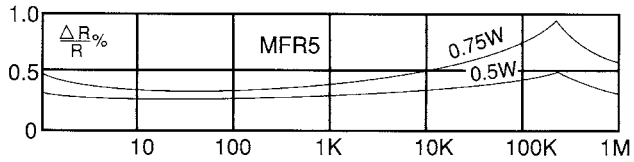
**MFR Series**

# Performance Data - Type MFR 5

| | | CECC 40101-019 Requirements | CECC 40101-803 Requirements | Actual Performance | |
|---|---|---|---|---|---|
| | | | | Maximum | Typical |
| Load at commercial rating : 1000 hours at 70°C | ΔR % | | | 0.9 | See Graph 3 |
| Load at CECC rating : 1000 hours at 70°C | ΔR % | 2 | 1 | 0.5 | See Graph 3 |
| Shelf life : 12 months at room temperature | ΔR % | Not specified | Not Specified | 0.1 | 0.07 |
| Derating | | zero at 155°C | zero at 155°C | | |
| Short term overload | ΔR % | 0.5 | 0.25 | 0.25 | 0.01 |
| Climatic | ΔR % | 2 | 1 | 0.5 | 0.2 |
| Climatic category | | 55/125/56 | 55/125/56 | | |
| Long term damp heat | ΔR % | 2 | 1 | 0.5 | 0.3 |
| Temperature rapid change | ΔR % | 0.5 | 0.25 | 0.25 | 0.04 |
| Resistance to solder heat | ΔR % | 0.5 | 0.25 | 0.25 | 0.07 |
| Vibration and bump | ΔR % | 0.5 | 0.25 | 0.1 | 0.01 |
| Noise. (in a decade of frequency) | μV/V | Not Specified | Not Specified | 0.1 | 0.07 |
| Insulation resistance | ohms | >1G | >1G | >1G | >1G |
| Voltage proof | volts | 700 min | 500 min | 700 min | 700 min |
| Pulse handling | | Data available upon request | | | |

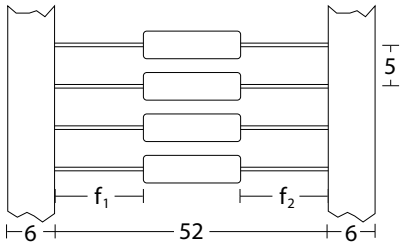



Graph 3 – Load for 1000 hours at 70°C: maximum changes

## Packaging

All MFR resistors are supplied tape packed ready for loading on to automatic sequencing and insertion machines. Component wires will not protrude beyond the outside edge of the tapes.

Alternative packaging available by request.




$f_1 - f_2 \leq 1.4$ mm

Lead Formed resistors can also be supplied. Standard options of Lancet, Radial and Goalpost forming are available.

## Construction

The resistance element is a precisely controlled thin film of metal alloy sputtered on to a high purity ceramic core, protected by a moisture-resistant, high dielectric strength coating applied so that terminations remain completely clear.

## Terminations

**Material** Hot tin dipped copper wire

**Strength** The terminations meet the requirements of IEC 68.2.21

**Solderability** The terminations meet the requirements of IEC 115-1, Clause 4.17.3.2

## Marking

0.5% and 1% tolerance resistors are colour coded with 5 bands. IEC 62 colours are used.

## Solvent Resistance

The body protection and marking are resistant to all normal industrial cleaning solvents suitable for printed circuits.

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**MFR Series**

# Ordering Procedure

**Example: MFR4-4K7FI** (Professional grade MFR4 at 4.7 kilohms ±1%, Pb-free)

| M | F | R | 4 | - | 4 | K | 7 | F | I | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | | | | 2 | | | 3 | 4 | |

| 1<br>Type | 2<br>Value | 3<br>Tolerance | 4<br>Grade, Finish & Packing | | | |
|---|---|---|---|---|---|---|
| MFR3 | E24 = 3/4 characters<br>E96 = 4/5 characters<br>R = ohms<br>K = kilohms<br>M = megohms | D = ±0.5% | C | MFR3, 4 | Commercial | Pb-free (RoHS) |
| MFR4 | | F = ±1% | I | MFR4, 5 | Professional | |
| MFR5 | | | All above in Standard Packing | | | |
| | | | MFR3, 4 | | Ammo | 5000/box |
| | | | MFR5 | | | 2500/box |

CECC release is available only for professional grade Pb-free parts (code I).
For CECC released product state on order the CECC number and style.
Example: **MFR4-4K7FI CECC40101-019 FZ**

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