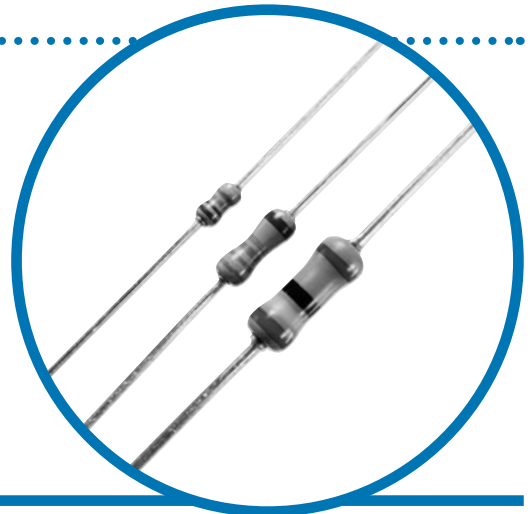


## MFR Series

- Professional grade approved to BSCECC 40101-803 and 019
- Tolerances down to 0.5%
- Temperature coefficient down to 50ppm/°C
- Optional RoHS compliant or Lead bearing wire finishes



## 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 <sup>1</sup> |
| Resistance tolerance     | %      | 1        | 0.5, 1   | 0.5, 1                       |

Note 1 - Tighter TCRs are available on professional grade, consult factory for details.

| 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              | 250              | 100       | 250      |
|                               |        | 5.1 to 9.1 : 200 | 5.1 to 9.1 : 500 |           |          |
| Resistance tolerance          | %      | 1                | 1                | 1         | 1        |

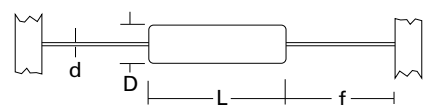
| CECC 40101 - 803 Requirements |        | BC       | BK       | CC       | CK       |
|-------------------------------|--------|----------|----------|----------|----------|
| Power rating at 70°C          | watts  | 0.125    | 0.125    | 0.25     | 0.25     |
| Resistance range              | ohms   | 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     |
|                              | Professional | 6.2   | 2.5   | 21.0  | 0.6   | 10.2              | 0.6             | 0.3     |
| MFR4                         | 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     |



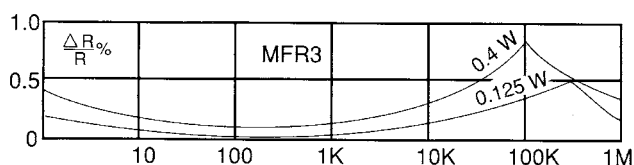
### General Note

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## Performance Data - Type MFR 3

|                                                |              | CECC 40101-019*<br>Requirements | Actual Performance |             |
|------------------------------------------------|--------------|---------------------------------|--------------------|-------------|
|                                                |              |                                 | Maximum            | Typical     |
| Load at commercial rating : 1000 hours at 70°C | $\Delta R$ % |                                 | 0.8                | See Graph 1 |
| Load at CECC rating : 1000 hours at 70°C       | $\Delta R$ % | 2                               | 0.5                | See Graph 1 |
| Shelf life : 12 months at room temperature     | $\Delta R$ % | Not Specified<br>zero at 155°C  | 0.1                | 0.07        |
| Derating                                       |              |                                 |                    |             |
| Short term overload                            | $\Delta R$ % | 0.5                             | 0.25               | 0.03        |
| Climatic                                       | $\Delta R$ % | 2                               | 0.5                | 0.2         |
| Climatic category                              |              | 55/125/56                       |                    |             |
| Long term damp heat                            | $\Delta R$ % | 2                               | 0.5                | 0.3         |
| Temperature rapid change                       | $\Delta R$ % | 0.5                             | 0.25               | 0.05        |
| Resistance to solder heat                      | $\Delta R$ % | 0.5                             | 0.25               | 0.02        |
| Vibration and bump                             | $\Delta R$ % | 0.5                             | 0.1                | 0.01        |
| Noise. (in a decade of frequency)              | $\mu V/V$    | 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     |                    |             |

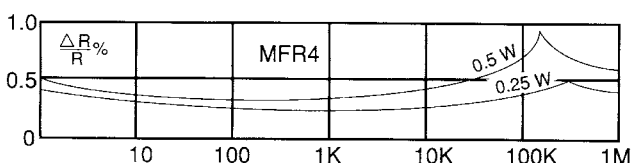
\* CECC requirements are included for reference only; CECC release is not available on MFR3



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

## Performance Data - Type MFR 4

|                                                |              | CECC 40101-019<br>Requirements | CECC 40101-803<br>Requirements | Actual Performance |             |
|------------------------------------------------|--------------|--------------------------------|--------------------------------|--------------------|-------------|
|                                                |              |                                |                                | Maximum            | Typical     |
| Load at commercial rating : 1000 hours at 70°C | $\Delta R$ % |                                |                                | 0.8                | See Graph 2 |
| Load at CECC rating : 1000 hours at 70°C       | $\Delta R$ % | 2                              | 1                              | 0.5                | See Graph 2 |
| Shelf life : 12 months at room temperature     | $\Delta R$ % | Not specified                  | Not Specified                  | 0.1                | 0.07        |
| Derating                                       |              | zero at 155°C                  | zero at 155°C                  |                    |             |
| Short term overload                            | $\Delta R$ % | 0.5                            | 0.25                           | 0.25               | 0.01        |
| Climatic                                       | $\Delta R$ % | 2                              | 1                              | 0.5                | 0.2         |
| Climatic category                              |              | 55/125/56                      | 55/125/56                      |                    |             |
| Long term damp heat                            | $\Delta R$ % | 2                              | 1                              | 0.5                | 0.3         |
| Temperature rapid change                       | $\Delta R$ % | 0.5                            | 0.25                           | 0.25               | 0.04        |
| Resistance to solder heat                      | $\Delta R$ % | 0.5                            | 0.25                           | 0.25               | 0.07        |
| Vibration and bump                             | $\Delta R$ % | 0.5                            | 0.25                           | 0.1                | 0.01        |
| Noise. (in a decade of frequency)              | $\mu V/V$    | 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    |                                |                    |             |



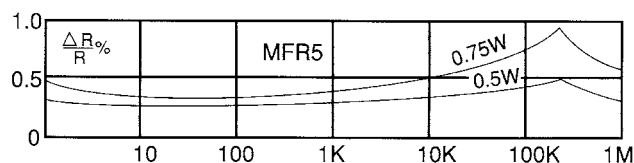
Graph 2 – Load for 1000 hours at 70°C: maximum changes

## General Note

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## Performance Data - Type MFR 5

|                                   |               | CECC 40101-019<br>Requirements | CECC 40101-803<br>Requirements | Actual Performance |             |
|-----------------------------------|---------------|--------------------------------|--------------------------------|--------------------|-------------|
|                                   |               |                                |                                | Maximum            | Typical     |
| Load at commercial rating :       |               |                                |                                |                    |             |
| 1000 hours at 70°C                | $\Delta R \%$ |                                |                                | 0.9                | See Graph 3 |
| Load at CECC rating :             |               |                                |                                |                    |             |
| 1000 hours at 70°C                | $\Delta R \%$ | 2                              | 1                              | 0.5                | See Graph 3 |
| Shelf life :                      |               |                                |                                |                    |             |
| 12 months at room temperature     | $\Delta R \%$ | Not specified                  | Not Specified                  | 0.1                | 0.07        |
| Derating                          |               | zero at 155°C                  | zero at 155°C                  |                    |             |
| Short term overload               | $\Delta R \%$ | 0.5                            | 0.25                           | 0.25               | 0.01        |
| Climatic                          | $\Delta R \%$ | 2                              | 1                              | 0.5                | 0.2         |
| Climatic category                 |               | 55/125/56                      | 55/125/56                      |                    |             |
| Long term damp heat               | $\Delta R \%$ | 2                              | 1                              | 0.5                | 0.3         |
| Temperature rapid change          | $\Delta R \%$ | 0.5                            | 0.25                           | 0.25               | 0.04        |
| Resistance to solder heat         | $\Delta R \%$ | 0.5                            | 0.25                           | 0.25               | 0.07        |
| Vibration and bump                | $\Delta R \%$ | 0.5                            | 0.25                           | 0.1                | 0.01        |
| Noise. (in a decade of frequency) | $\mu V/V$     | 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    |                                |                    |             |

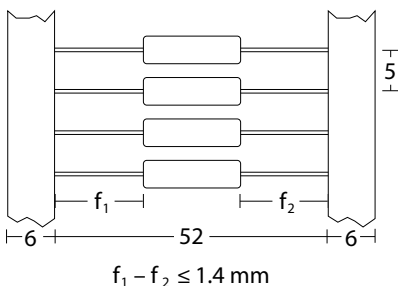


Graph 3 – Load for 1000 hours at 70°C: maximum changes

## 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.



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.

## General Note

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# Ordering Procedure

Example: Professional grade MFR4 at 4.7 kilohms and 1% tolerance in ammo pack box of 5000 pieces -

MFR4

-

4K7

F

I

Type

Value (use IEC62 code)

Tolerance (use IEC62 code)

Packing / Grade

|   |      |
|---|------|
| D | 0.5% |
| F | 1%   |

|   |      |            |          |                                                                                          |
|---|------|------------|----------|------------------------------------------------------------------------------------------|
| C | Ammo | MFR3, MFR4 | 5000/box | Commercial Grade                                                                         |
| I |      | MFR4       | 5000/box | Professional Grade. CECC release is available within range indicated in Electrical Data. |
|   |      | MFR5       | 2500/box |                                                                                          |

For CECC released product state on order the CECC number and style.  
Example: **MFR4-4K7FI CECC40101-019 FZ**

For SnPb finish (nominal 5% Pb) instead of Pb-free, replace the packing suffix with **PB**. Example: **MFR4-4K7FPB**

For SnPb finish (nominal 40% Pb) instead of Pb-free, replace the packing suffix with **HL**. Example: **MFR4-4K7FHL**

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