

MFR Series

Features:

- MFR4 available to IECQ-CECC40101-019 and 803
- Tolerances down to 0.5%
- Temperature coefficient of resistance 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

| MFR Actual Data | | MFR3 | MFR4 | MFR5 |
|---------------------------|--------|---------------------|---|----------------------|
| Power rating @70°C | W | 0.4 | 0.5 | 0.75 |
| Resistance range | ohms | 10R – 1M0 | 1R0 – 1M0 | |
| Limiting element voltage | V | 200 | 350 | |
| TCR | ppm/°C | 50 | | ≤10R: 150, >10R: 100 |
| Resistance tolerance | % | 1 | 0.5, 1 | |
| Standard values | | E24 & E96 preferred | | |
| Thermal impedance | °C/W | 150 | 140 | 112 |
| Ambient temperature range | °C | -55 to 155 | | |
| Product grades available | | Commercial (...C) | Commercial (...C), Professional (...I) | Professional (...I) |

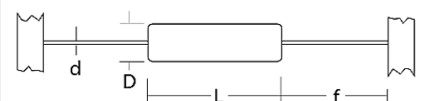
The requirements of the following standards are met or exceeded by the corresponding MFR series products above.

| IECQ-CECC 40101-019 Requirements | | FZ | FX |
|-----------------------------------|--------|-----------------------------------|-----------------------------------|
| Required power rating @70°C | W | 0.25 | |
| Qualified resistance range | ohms | 1R0 – 1M0 | |
| Required limiting element voltage | V | 250 | |
| Required TCR | ppm/°C | ≥5R1 - ≤9R1: 200, >9R1: 100 | ≥5R1 - ≤9R1: 500, >9R1: 250 |
| Required resistance tolerance | % | 1 | |

| IECQ-CECC 40101-803 Requirements | | BC | BK |
|-----------------------------------|--------|-----------|-----|
| Required power rating @70°C | W | 0.125 | |
| Qualified resistance range | ohms | 10R – 1M0 | |
| Required limiting element voltage | V | 200 | |
| Required TCR | ppm/°C | 50 | 100 |
| Required resistance tolerance | % | 0.5, 1 | |

Physical Data

| Dimensions in mm and weight in g | | | | | | | | |
|----------------------------------|--------------|-------|-------|-------|-------|-------------------|------------------|---------|
| Type | Grade | L max | D max | f min | d nom | PCB mount centres | Min. bend radius | Wt. nom |
| MFR3 | Commercial | 3.7 | 2 | 22.4 | 0.45 | 7.6 | 0.5 | 0.1 |
| MFR4 | | 6.8 | 3 | | 0.55 | 10.2 | 0.6 | 0.3 |
| MFR4 | Professional | 6.2 | 2.5 | 21 | 0.6 | | | |
| MFR5 | | | 9 | 3.6 | 19.6 | 0.8 | 12.7 | 1.2 |



General Note

TT Electronics reserves the right to make changes in product specification without notice or liability. All information is subject to TT Electronics' own data and is considered accurate at time of going to print.

MFR Series

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

Terminations are hot tin dipped copper wire. They meet the strength requirements of IEC 60115-1 clause 9.5 and the solderability requirements of IEC 60115-1 clause 11.1.

Marking

0.5% and 1% tolerance resistors are colour coded with 5 bands according to IEC 60062.

Solvent Resistance

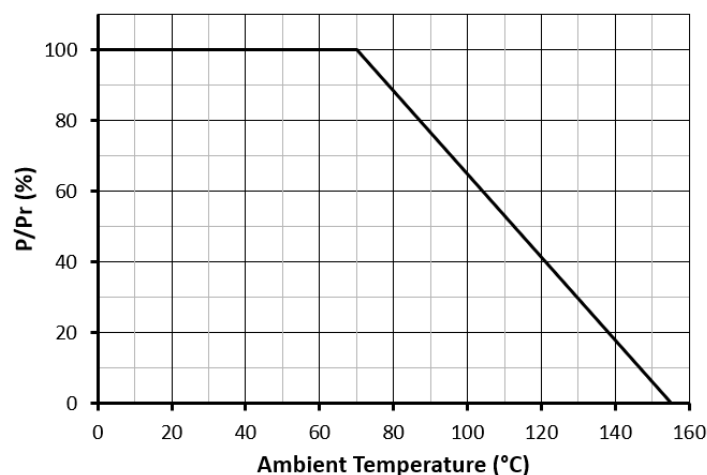
The body protection and marking are resistant to all normal industrial cleaning solvents suitable for printed circuit boards.

Performance Data

| | | IECQ-CECC 40101 Requirements (MFR4) | | Actual Performance (all types) | |
|---|------|-------------------------------------|-------------------------|---------------------------------|--------------------------------------|
| | | -019 | -803 | Maximum | Typical |
| Load at full rated power: P _r for 1000 hours at 70°C | ±ΔR% | Not specified | | MFR3, MFR4: 0.8 MFR5: 0.9 | See Typical Load Stability graphs |
| Load at IECQ-CECC40101 ratings: 1000 hours at 70°C | ±ΔR% | 2 | 1 | 0.5 | |
| Shelf-life test: 12 months at room temperature | ±ΔR% | Not specified | | 0.1 | 0.07 |
| Derating from rated power at 70°C | | 35.3% @125°C | 50% @125°C ¹ | Zero @155°C | |
| Short term overload: Lesser of 6.25xP _r or 2.5xLEV for 5s | ±ΔR% | 0.5 | 0.25 | 0.25 | MFR3: 0.03 MFR4, MFR5: 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 | MFR3: 0.05 MFR4, MFR5: 0.04 |
| Resistance to solder heat | ±ΔR% | 0.5 | 0.25 | 0.25 | MFR3: 0.02 MFR4, MFR5: 0.07 |
| Vibration & bump | ±ΔR% | 0.5 | 0.25 | 0.1 | 0.01 |
| Noise in a decade of frequency | μV/V | Not specified | | 0.1 | MFR3, MFR5: 0.07 MFR4: 0.1 |
| Insulation resistance | ohms | >1GΩ | | >1GΩ | |
| Voltage proof | V | 500 | 400 | MFR3: 400, MFR4: 500, MFR5: 700 | |

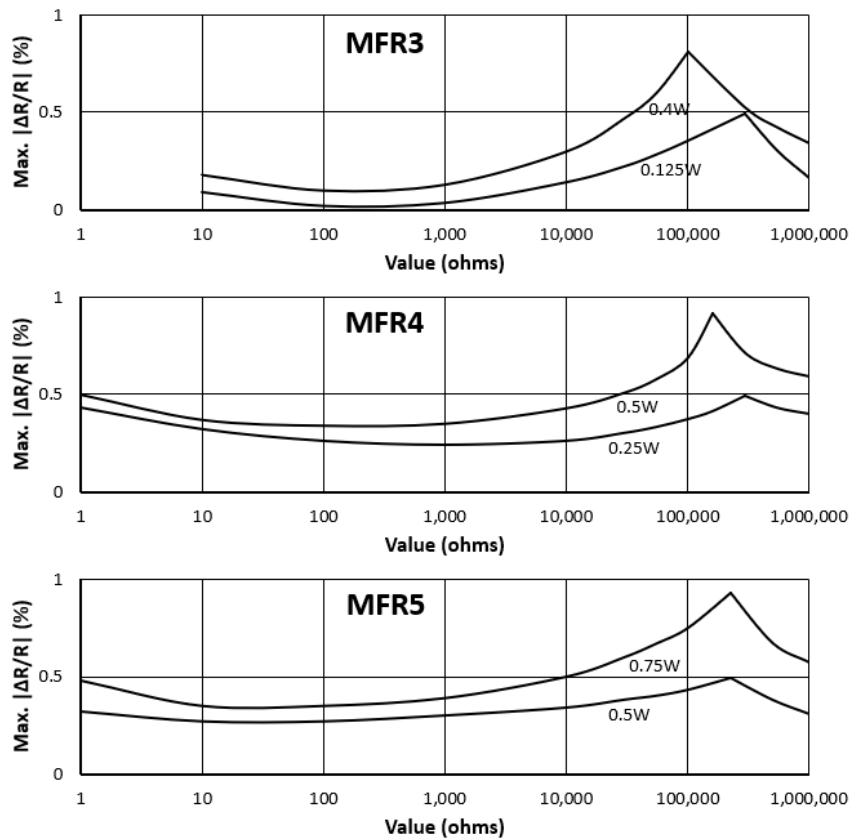
Note 1: This is 50% of the IECQ-CECC 40101-803 required rating, which itself is only ¼ of the full rated power. It is therefore within the actual zero at 155°C derating characteristic.

Temperature Derating



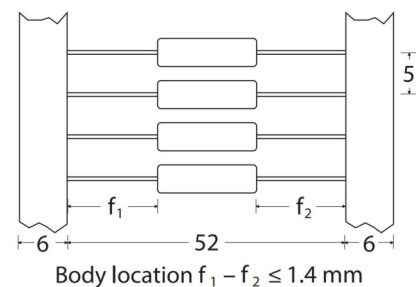
Typical Load Stability

1000 hour load at 70°C and stated power



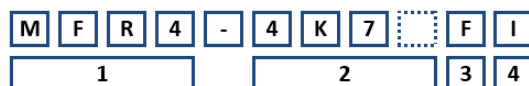
Packaging

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.



Ordering Procedure

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



| 1 | 2 | 3 | 4 | | | |
|------|--|-----------|-------------------------|------------|--------------------|------------------|
| Type | Value | Tolerance | Grade, Finish & Packing | | | |
| MFR3 | E24 = 3/4 characters | D = ±0.5% | C | MFR3, MFR4 | Commercial grade | Standard packing |
| MFR4 | E96 = 3/4 characters | F = ±1% | I | MFR4, MFR5 | Professional grade | & Pb-free |
| MFR5 | R = ohms K = kilohms M = megohms | | Standard Packing | | | |
| | | | MFR3, MFR4 | Ammo | 5000/box | |
| | | | MFR5 | | 2500/box | |

Note: CECC release is available only for professional grade Pb-free parts (code I). For CECC released product follow the MPN with text indicating the relevant release and style. Note that this additional text does not form part of our MPN.

Example: **MFR4-4K7FI** IECQ-CECC 40101-019 FZ