# MFSA

## SMD current sensing resistor-metal foil



### Applications

- Switched-mode power supply (SMPS)
- Voltage regulator module
- Power management
- Stepper motor drives

### Environmental compliance

Pb HALOGEN HF FREE RoHS

### Product features

- Low sensing resistance
- 0402 (1005 metric) to 1206 (3216 metric)
- High power dissipation
- AEC-Q200 compliant
- Moisture sensitivity level (MSL): 1

**Table 1. Part numbering configuration scheme**

**MFS @ xxxx Rxxxx * ? M**

| | |
|---|---|
| **Family name** | MFS |
| **Grade option** | A = Automotive grade |
| **Footprint EIA option** | 0402, 0603, 0805, 1206<br>0508 = 0805 wide terminal<br>0612= 1206 wide terminal |
| **Resistance option** | Rxxxx = xxx.x mΩ<br>ex: R0100 = 10.0 mΩ |
| **Resistance tolerance option** | F = ±1% |
| **Power rating option** | A =1/4 W, S =1/2 W,<br>I =3/4 W, C =1 W,<br>D = 1.5 W |
| **Metal material option** | M = MnCu |

See electrical specification table for option details

Powering Business Worldwide

### Mechanical parameters- Inches [mm]

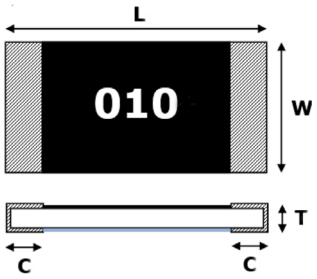



**Figure A**

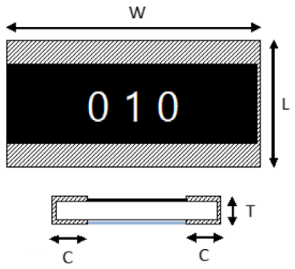
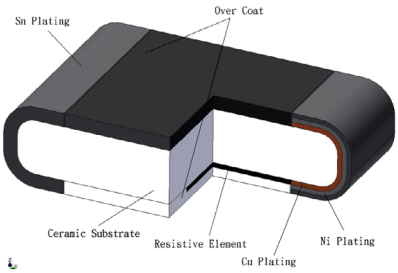


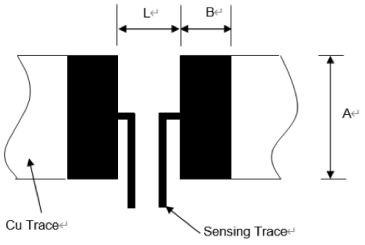

**Figure B**

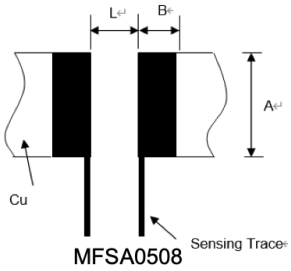
### Construction




| Family | Size code | L | W | C | T | Figure |
|---|---|---|---|---|---|---|
| MFSA0402 | 0402<br>[1005] | 0.040 ± 0.004<br>[1.0 ± 0.10] | 0.020 ± 0.004<br>[0.55 ± 0.10] | 0.012 ± 0.004<br>[0.30 ± 0.10] | 0.018 ± 0.004<br>[0.45 ± 0.10] | A |
| MFSA0603 | 0603<br>[1608] | 0.063 ± 0.008<br>[1.60 ± 0.20] | 0.031 ± 0.008<br>[0.80 ± 0.20] | 0.016 ± 0.008<br>[0.40 ± 0.20] | 0.028 ± 0.008<br>[0.70 ± 0.20] | A |
| MFSA0805 | 0805<br>[2012] | 0.079 ± 0.008<br>[2.0 ± 0.20] | 0.049 ± 0.008<br>[1.25 ± 0.20] | 0.016 ± 0.012<br>[0.40 ± 0.30] | 0.028 ± 0.008<br>[0.70 ± 0.20] | A |
| MFSA1206 | 1206<br>[3216] | 0.126 ± 0.008<br>[3.20 ± 0.20] | 0.063 ± 0.008<br>[1.60 ± 0.20] | 0.020 ± 0.012<br>[0.50 ± 0.30] | 0.028 ± 0.008<br>[0.70 ± 0.20] | A |
| MFSA0508 | 0508<br>[1220] | 0.049 ± 0.008<br>[1.25 ± 0.20] | 0.079 ± 0.008<br>[2.0 ± 0.20] | 0.016 ± 0.008<br>[0.40 ± 0.20] | 0.020 ± 0.008<br>[0.50 ± 0.20] | B |
| MFSA0612 | 0612<br>[1632] | 0.063 ± 0.008<br>[1.60 ± 0.20] | 0.126 ± 0.008<br>[3.20 ± 0.20] | 0.016 ± 0.008<br>[0.40 ± 0.20] | 0.020 ± 0.008<br>[0.50 ± 0.20] | B |

### Recommended PCB layout- mm




| Family | Resistance (mΩ) | A | L | B |
|---|---|---|---|---|
| MFSA0402 | 10 ~ 20 | 0.7 | 0.45 | 0.375 |
| MFSA0603 | 5 ≤ R ≤ 20 | 1 | 0.6 | 1.1 |
| MFSA0805 | 5 ≤ R ≤ 30 | 1.4 | 1.2 | 1 |
| MFSA1206 | 5 ≤ R ≤ 30 | 1.8 | 1.6 | 1.55 |
| | 31 ≤ R ≤ 40 | 1.8 | 2.2 | 1.35 |
| MFSA0508 | 5 ≤ R ≤ 10 | 2.4 | 0.45 | 0.875 |
| MFSA0612 | 1 ≤ R ≤ 20 | 3.8 | 0.85 | 0.625 |

1. The copper foil thickness of PCB needs 3 oz. minimum
2. PCB layout dimension tolerance is +/-0.1 mm.
3. The Resistance will change slightly after soldered; it is dependent on PCB pad size deign and it's necessary to consider the effect of the resistance increase or decrease.

### Part marking

| Family | Marking |
|---|---|
| MFSA0402 | No marking |
| MFSA0603 | No marking |
| MFSA0805 | xxx: (xxx= resistance value in ohms expressed in 3 digits)<br>005 = 0.005 Ω or 5 mΩ<br>010 = 0.010 Ω or 10 mΩ<br>exception: 6.5 = 0.0065 Ω or 6.5 mΩ |
| MFSA1206 | |
| MFSA0508 | No marking |
| MFSA0612 | xxx: (xxx= resistance value in ohms expressed in 3-4 digits<br>0025 = 0.0025 Ω or 2.5 mΩ<br>005 = 0.005 Ω or 5 mΩ<br>010 = 0.010 Ω or 10 mΩ |

## Electrical specifications

| Part number | Size | Grade option | Resistance value mΩ (Part number code) | Resistance tolerance (Part number code) | Power rating (Part number code) | TCR (ppm/°C) | Operating temperature |
|---|---|---|---|---|---|---|---|
| MFS@0402Rxxxx*?M | 0402 (1005 metric) | A | 10 (0100) | ±1% (F) | 1/4 W (A) | ± 100 | -55 °C to +125 °C |
| MFS@0402Rxxxx*?M | 0402 (1005 metric) | A | 20 (0200) | ±1% (F) | 1/4 W (A) | ± 100 | -55 °C to +125 °C |
| MFS@0603Rxxxx*?M | 0603 (1608 metric) | A | 5 (0050) | ±1% (F) | 1/2 W (S) | ± 50 | -55 °C to +155 °C |
| MFS@0603Rxxxx*?M | 0603 (1608 metric) | A | 7 (0070) | ±1% (F) | 1/2 W (S) | ± 50 | -55 °C to +155 °C |
| MFS@0603Rxxxx*?M | 0603 (1608 metric) | A | 9 (0090) | ±1% (F) | 1/2 W (S) | ± 50 | -55 °C to +155 °C |
| MFS@0603Rxxxx*?M | 0603 (1608 metric) | A | 10 (0100) | ±1% (F) | 1/2 W (S) | ± 50 | -55 °C to +155 °C |
| MFS@0603Rxxxx*?M | 0603 (1608 metric) | A | 15 (0150) | ±1% (F) | 1/2 W (S) | ± 50 | -55 °C to +155 °C |
| MFS@0603Rxxxx*?M | 0603 (1608 metric) | A | 20 (0200) | ±1% (F) | 1/2 W (S) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 5(0050) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 6 (0060) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 6.5 (0065) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 7 (0070) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 8 (0080) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 9 (0090) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 10 (0100) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 15 (0150) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 20 (0200) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 25 (0250) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@0805Rxxxx*?M | 0805 (2012 metric) | A | 30 (0300) | ±1% (F) | 3/4 W (I) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 5 (0050) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 6 (0060) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 8 (0080) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 10 (0100) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 11 (0110) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 12 (0120) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 15 (0150) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 17 (0170) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 18 (0180) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 20 (0200) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 22 (0220) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 25 (0250) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 27 (0270) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 30 (0300) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 33 (0330) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@1206Rxxxx*?M | 1206 (3216 metric) | A | 40 (0400) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |

@= Enter grade option code from table above (A=Automotive)
Rxxxx = Eneter resistance code option from table above xxxx= resistance code (xxx.x mΩ ex: R0100 = 10.0 mΩ)
*= Enter resistance tolerance code option from table above (F= ±1%)
?= Enter power rating code option from table above (A =1/4 W, S =1/2 W, I =3/4 W, C =1 W, D = 1.5 W)
M=MnCu (Metal material)

## Electrical specifications

| Part number | Size | Grade option | Resistance value mΩ (Part number code) | Resistance tolerance (Part number code) | Power rating (Part number code) | TCR (ppm/°C) | Operating temperature |
|---|---|---|---|---|---|---|---|
| MFS@0508Rxxxx*?M | 0508 (1220 metric) | A | 5 (0050) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@0508Rxxxx*?M | 0508 (1220 metric) | A | 10 (0100) | ±1% (F) | 1 W (C) | ± 50 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 2 (0020) | ±1% (F) | 1.5 W (D) | ± 75 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 3 (0030) | ±1% (F) | 1.5 W (D) | ± 75 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 4 (0040) | ±1% (F) | 1.5 W (D) | ± 75 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 5 (0050) | ±1% (F) | 1.5 W (D) | ± 50 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 6 (0060) | ±1% (F) | 1.5 W (D) | ± 50 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 6.5 (0065) | ±1% (F) | 1.5 W (D) | ± 50 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 7 (0070) | ±1% (F) | 1.5 W (D) | ± 50 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 8 (0080) | ±1% (F) | 1.5 W (D) | ± 50 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 9 (0090) | ±1% (F) | 1.5 W (D) | ± 50 | -55 °C to +155 °C |
| MFS@0612Rxxxx*?M | 0612 (1632 metric) | A | 10 (0100) | ±1% (F) | 1.5 W (D) | ± 50 | -55 °C to +155 °C |

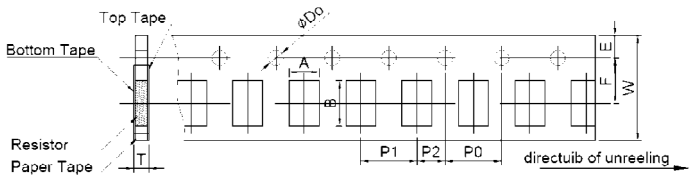
@= Enter grade option code from table above (A=Automotive)
Rxxxx = Eneter resistance code option from table above xxxx= resistance code (xxx.x mΩ ex: R0100 = 10.0 mΩ)
*= Enter resistance tolerance code option from table above (F= ±1%)
?= Enter power rating code option from table above (A =1/4 W, S =1/2 W, I =3/4 W, C =1 W, D = 1.5 W)
M=MnCu (Metal material)

## Packaging information- mm

Supplied in tape and reel on a 7.0" diameter reel (EIA-481 compliant)

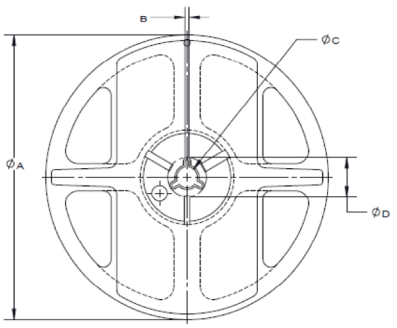
| Size | Tape | Quantity |
|---|---|---|
| 0402 | 7 inch paper | 10K |
| 0603 | 7 inch paper | 5K |
| 0805 | 7 inch paper | 4K |
| 1206 | 7 inch paper | 4K |
| 0508 | 7 inch paper | 4K |
| 0612 | 7 inch paper | 4K |

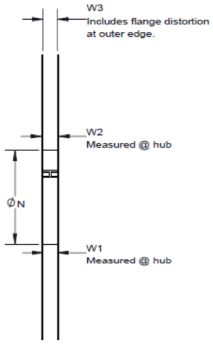
### Tape carrier and dimensions




| Dimension | 0402 | 0603 | 0805 | 1206 | 0508 | 0612 |
|---|---|---|---|---|---|---|
| E1 | 1.75 ± 0.1 | 1.75 ± 0.1 | 1.75 ± 0.1 | 1.75 ± 0.1 | 1.75 ± 0.1 | 1.75 ± 0.1 |
| F | 3.5 ± 0.05 | 3.5 ± 0.05 | 3.5 ± 0.05 | 3.5 ± 0.05 | 3.5 ± 0.05 | 3.5 ± 0.05 |
| P2 | 2.0 ± 0.1 | 2.0 ± 0.1 | 2.0 ± 0.1 | 2.0 ± 0.1 | 2.0 ± 0.1 | 2.0 ± 0.1 |
| D0 | 1.5 ± 0.1 | 1.5 ± 0.1 | 1.5 ± 0.1 | 1.5 ± 0.1 | 1.5 ± 0.1 | 1.5 ± 0.1 |
| P0 | 4.0 ± 0.1 | 4.0 ± 0.1 | 4.0 ± 0.1 | 4.0 ± 0.1 | 4.0 ± 0.1 | 4.0 ± 0.1 |
| W | 8.0 ± 0.2 | 8.0 ± 0.2 | 8.0 ± 0.2 | 8.0 ± 0.2 | 8.0 ± 0.2 | 8.0 ± 0.2 |
| P1 | 4.0 ± 0.1 | 4.0 ± 0.1 | 4.0 ± 0.1 | 4.0 ± 0.1 | 4.0 ± 0.1 | 4.0 ± 0.1 |
| A0 | 0.75 ± 0.05 | 1.1 ± 0.15 | 1.6 ± 0.15 | 2.0 ± 0.15 | 1.6 ± 0.15 | 2.0 ± 0.15 |
| B0 | 1.3 ± 0.05 | 1.9 ± 0.2 | 2.4 ± 0.2 | 3.6 ± 0.2 | 2.4 ± 0.2 | 3.6 ± 0.2 |
| T | 0.65 ± 0.1 | 0.85 ± 0.1 | 1.05 ± 0.1 | 1.05 ± 0.1 | 1.05 ± 0.1 | 1.05 ± 0.1 |

### Reel dimensions



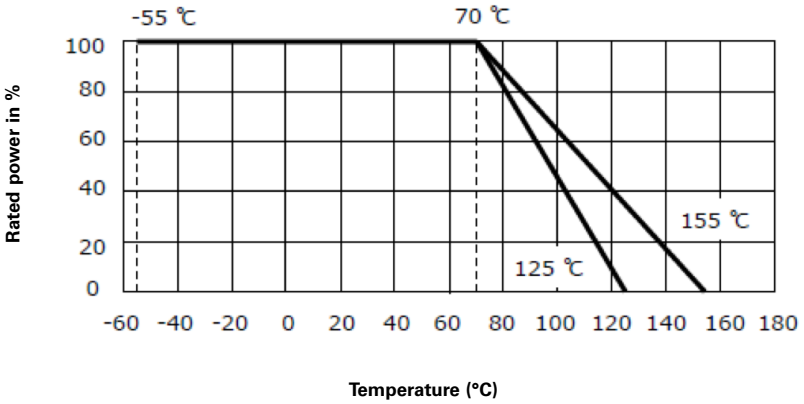




| Size | A | B | C | D | N | W1 | W2 | W3 |
|---|---|---|---|---|---|---|---|---|
| 0402 | 178 ± 2.0 | 3.5 ± 0.5 | 13.0 ± 1.0 | na | 60 ± 1.0 | 9.0 ± 1.0 | 11.4 ± 1.0 | na |
| 0603 | 178 ± 2.0 | 3.5 ± 0.5 | 13.0 ± 1.0 | na | 60 ± 1.0 | 9.0 ± 1.0 | 11.4 ± 1.0 | na |
| 0805 | 178 ± 2.0 | 3.5 ± 0.5 | 13.0 ± 1.0 | na | 60 ± 1.0 | 9.0 ± 1.0 | 11.4 ± 1.0 | na |
| 1206 | 178 ± 2.0 | 3.5 ± 0.5 | 13.0 ± 1.0 | na | 60 ± 1.0 | 9.0 ± 1.0 | 11.4 ± 1.0 | na |
| 0508 | 178 ± 2.0 | 3.5 ± 0.5 | 13.0 ± 1.0 | na | 60 ± 1.0 | 9.0 ± 1.0 | 11.4 ± 1.0 | na |
| 0612 | 178 ± 2.0 | 3.5 ± 0.5 | 13.0 ± 1.0 | na | 60 ± 1.0 | 9.0 ± 1.0 | 11.4 ± 1.0 | na |

## General specifications

| |
|---|
| Insulation resistance: > 100 MΩ |
| Temperature coefficient of resistance: IEC60115-1 4.8, +25 °C to +125 °C |
| Short time overload: IEC60115-1 4.13, 5 X rated power for 5 s |
| High temperature exposure (storage): AEC-Q200-REV D-test 3, MIL-STD202 Method 108, 1000 hours. @ Tup, Max operation temperature |
| Temperature cycling: AEC-Q200-REV D-Test 4, JESD22 Method JA-104, 1000 cycles (-55 °C to +125 °C), 30 minute maximum dwell time at each temperature extreme. 1 minute maximum transition time. |
| Moisture resistance: AEC-Q200-REV D-Test 6 , MIL-STD-202 method 106, 24 hours per cycle, 10 cycles, Notes: Steps 7a& 7b not required. Unpowered |
| Biased humidity: AEC-Q200-REV D-Test 7, MIL-STD-202 method 103, 1000 hours +85 °C/85% RH. Note: Specified conditions: 10% of operating power (not exceeding max working voltage). |
| Operational life: AEC-Q200-REV D-Test 8, MIL-STD-202 method 108, 1000 hours, +125 °C at 35% rated power. |
| Resistance to solvents: AEC-Q200-REV D-Test 12, MIL-STD-202 method 215, a: Isopropyl alcohol : mineral spirits= 1 : 3, b: Terpene defluxer (Bioact EC-7R) c: Deionized water : Propylene glycol Monomethyl ether : monoethanolamine = 42 : 1 |
| Mechanical shock: AEC-Q200-REV D-Test 13, MIL-STD-202 Method 213, half sine shock pulse, peak value is 100 g's. Normal duration (D) is 6 (ms), |
| Vibration: AEC-Q200-REV D-Test 14, MIL-STD-202 method 204, 5 g's for 20 minutes, 12 cycles each of 3 orientations. Test from 10-2000 Hz |
| Resistance to soldering heat: AEC-Q200-REV D-Test 15, MIL-STD-202 method 210, Condition B : Immerse in eutectic solder at +260 °C ± 5 °C for 10 ± 1 second |
| Thermal shock: AEC-Q200-REV D-Test 16, MIL-STD-202 method 107, -55 °C/+155 °C. 300 cycles, Maximum transfer time 20 seconds, Dwell time 15 minutes. Air-Air |
| ESD: AEC-Q200-REV D-Test 17, AEC-Q200-002 or ISO/DIS 10605, verify the voltage setting at 500 V |
| Solderability: AEC-Q200-REV D-Test 18, J-STD-002, method B, aging 4 hours at +155 °C dry heat Lead-free solder bath at +235 °C ± 3 °C, Dipping time: 3 ± 0.5 seconds, > 95% area covered with tin |
| Flammability: AEC-Q200-REV D-Test 20, UL-94, V-0 or V-1 are acceptable. |
| Board flex (bending): AEC-Q200-REV D-Test 21, AEC-Q200-005, The duration of the applied forces shall be 60 (+ 5) seconds, 2 mm deflection |
| Terminal strength (SMD): AEC-Q200-REV D-Test 22, AEC-Q200-006, Force of 1.8 kg for 60 seconds |

## Temperature derating curve




## Rated current & voltage

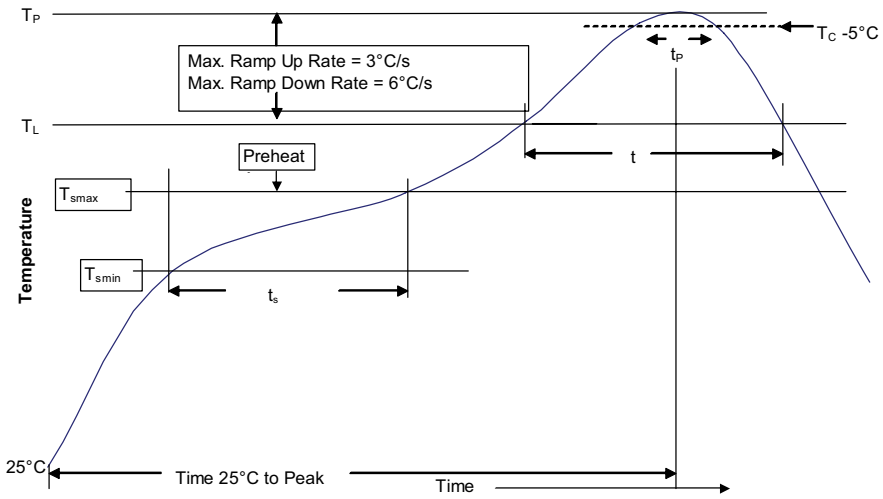
The rated Current and Voltage are calculated by the following formula:

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

I: Rated current (A) V: Rated voltage (V)

P: Rated power (W) R: Resistance value (Ω)

## Solder reflow profile




| Profile feature | | Lead (Pb) free solder |
|---|---|---|
| Preheat and soak | • Temperature min. ($T_{smin}$) | 150 °C |
| | • Temperature max. ($T_{smax}$) | 200 °C |
| | • Time ($T_{smin}$ to $T_{smax}$) ($t_S$) | 60-150 seconds |
| Ramp up rate $T_L$ to $T_p$ | | 3 °C/ second max. |
| Liquidous temperature ($T_L$)<br>Time ($t_L$) maintained above $T_L$ | | 217 °C<br>60-120 seconds |
| Peak package body temperature ($T_P$)* | | 260 °C |
| Time ($t_p$)* within 5 °C of the specified classification temperature ($T_C$) | | 10 seconds* |
| Ramp-down rate ($T_p$ to $T_L$) | | 6 °C/ second max. |
| Time 25 °C to peak temperature | | 8 minutes max. |

* Tolerance for peak profile temperature ($T_p$) is defined as a supplier minimum and a user maximum.

## Manual solder

+350 °C ±10 °C , 3 +1/-0 seconds 1 time (by soldering iron), generally manual, hand soldering is not recommended

Life Support Policy: Eaton does not authorize the use of any of its products for use in life support devices or systems without the express written approval of an officer of the Company. Life support systems are devices which support or sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.

Eaton reserves the right, without notice, to change design or construction of any products and to discontinue or limit distribution of any products. Eaton also reserves the right to change or update, without notice, any technical information contained in this bulletin.

**Eaton**
**Electronics Division**
1000 Eaton Boulevard
Cleveland, OH 44122
United States
Eaton.com/electronics

© 2022 Eaton
All Rights Reserved
Printed in USA
Publication No. ELX1180 BU-ELX22040
June 2022

Eaton is a registered trademark.

All other trademarks are property of their respective owners.

Follow us on social media to get the latest product and support information.