

Metal Foil Current Sense Resistors, Low Value (Down to 0.001 Ω)



FEATURES

- Ultra low sensing resistance
- Low TCR (down to 50 ppm/°C)
- Chip size down to 0402, minimizing board space
- Sulfur resistant
- Material categorization:
for definitions of compliance please see www.vishay.com/doc?99912



RoHS
COMPLIANT
HALOGEN
FREE
GREEN
(5-2008)

APPLICATIONS

- Switching power supply
- Voltage regulation module
- DC/DC converter, adaptor, battery pack, charger
- Pad and cell phone
- Power management

| STANDARD ELECTRICAL SPECIFICATIONS | | | | | |
|------------------------------------|------|----------------|---------------|--------------------------|--------------------------------|
| GLOBAL MODEL | SIZE | POWER RATING W | TOLERANCE % | RESISTANCE VALUE RANGE Ω | WEIGHT (typical) g/1000 pieces |
| WFC0402 | 0402 | 0.125 | ± 1, ± 2, ± 5 | 0.003 to 0.05 | 1.1 |
| WFC0603 | 0603 | 0.33 | ± 1, ± 2, ± 5 | 0.001 to 0.005 | 3.3 |
| | 0603 | 0.25 | ± 1, ± 2, ± 5 | 0.0051 to 0.03 | 3.3 |
| WFC0805 | 0805 | 0.50 | ± 1, ± 2, ± 5 | 0.001 to 0.04 | 6.8 |
| WFC1206 | 1206 | 1.0 | ± 1, ± 2, ± 5 | 0.001 to 0.05 | 17.4 |
| | 1206 | 0.5 | ± 1, ± 2, ± 5 | 0.100 to 0.18 | 17.4 |

| GLOBAL PART NUMBER INFORMATION | | | | | | | | | | | | | | | | |
|---|---|---|------------------------------|---|---|---|---|---|---|---|---|---|---|--------------------------------------|---|--|
| Global Part Numbering Example: WFC1206R0100FE66 | | | | | | | | | | | | | | | | |
| W | F | C | 1 | 2 | 0 | 6 | R | 0 | 1 | 0 | 0 | F | E | 6 | 6 | |
| GLOBAL MODEL (3 digits) | | | CASE SIZE (EIA) (4 digits) | | | | RESISTANCE VALUE (5 digits) ⁽¹⁾ | | | | | TOLERANCE CODE (1 digit) | | PACKAGING CODE (3 digits) | | |
| WFC | | | 0402 0603 0805 1206 | | | | L = mΩ ⁽²⁾ R = decimal 5L000 = 0.005 Ω R0100 = 0.01 Ω | | | | | F = ± 1.0 % G = ± 2.0 % J = ± 5.0 % | | E66 = lead (Pb)-free 7" tape/reel | | |

Notes

⁽¹⁾ Resistance values are available per E12 and E24 decades; www.vishay.com/doc?28372

⁽²⁾ Use "L" for resistance values < 0.01 Ω

| TECHNICAL SPECIFICATIONS | | | | | |
|-----------------------------|--------|----------------------------|-----------------------------|------------------------------|-------------------------------|
| PARAMETER | UNIT | RESISTOR CHARACTERISTICS | | | |
| | | WFC0402 | WFC0603 | WFC0805 | WFC1206 |
| Temperature coefficient | ppm/°C | - | ± 100 for 1 mΩ to 5 mΩ | - | - |
| | | ± 150 for 3 mΩ to 7 mΩ | ± 150 for 5.1 mΩ to 9 mΩ | ± 100 for 1 mΩ to 10 mΩ | ± 100 for 1 mΩ to 10 mΩ |
| | | ± 100 for 8 mΩ to 50 mΩ | ± 75 for 10 mΩ to 30 mΩ | ± 50 for 10.1 mΩ to 40 mΩ | ± 50 for 10.1 mΩ to 180 mΩ |
| Operating temperature range | °C | -55 to +170 | | | |
| Maximum working voltage | V | $(P \times R)^{1/2}$ | | | |
| Maximum element temperature | °C | 170 | | | |

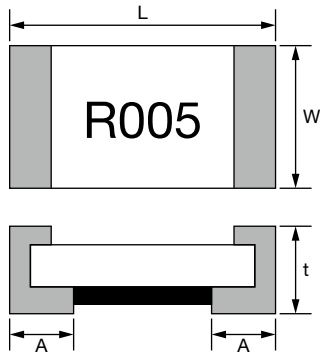
DIMENSIONS in inches (millimeters)


Fig. 1

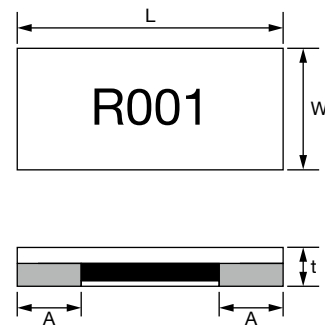
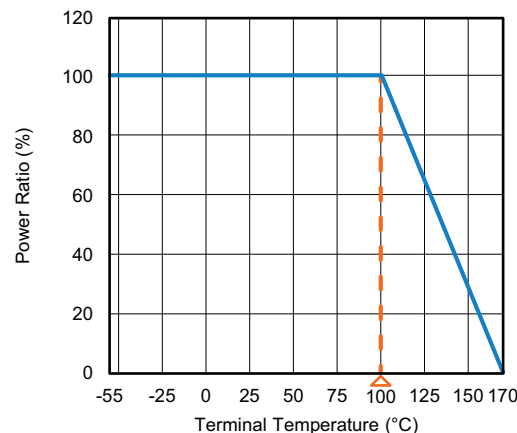


Fig. 2

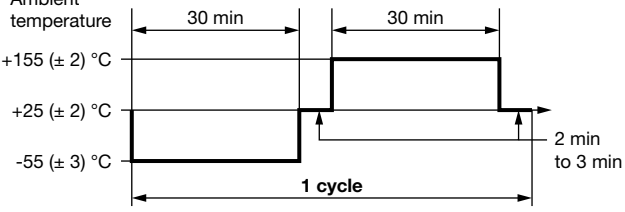
| TYPE (INCH SIZE) | RESISTANCE RANGE (mΩ) | DIMENSIONS (in millimeters) | | | | DIMENSIONS FIG. |
|---------------------|--------------------------|-----------------------------|-------------|-------------|-------------|-----------------|
| | | L | W | t | A | |
| WFC0402 | 3 to 7 | 1.00 ± 0.10 | 0.55 ± 0.10 | 0.45 ± 0.10 | 0.35 ± 0.10 | 1 |
| | 7.1 to 50 | | | | 0.25 ± 0.10 | 1 |
| WFC0603 | 1 to 5 | 1.60 ± 0.10 | 0.95 ± 0.25 | 0.60 ± 0.25 | 0.55 ± 0.20 | 2 |
| | 5.1 to 30 | | 0.80 ± 0.10 | 0.55 ± 0.15 | 0.30 ± 0.20 | 1 |
| WFC0805 | 1 to 5 | 2.10 ± 0.20 | 1.40 ± 0.20 | 0.60 max. | 0.60 ± 0.20 | 2 |
| | 5.1 to 40 | 2.00 ± 0.20 | 1.30 ± 0.15 | 0.70 ± 0.15 | 0.45 ± 0.20 | 1 |
| WFC1206 | 1 to 3 | 3.10 ± 0.20 | 1.55 ± 0.20 | 0.75 ± 0.25 | 1.30 ± 0.20 | 2 |
| | 3.1 to 180 | | | 0.80 ± 0.15 | 0.55 ± 0.20 | 1 |

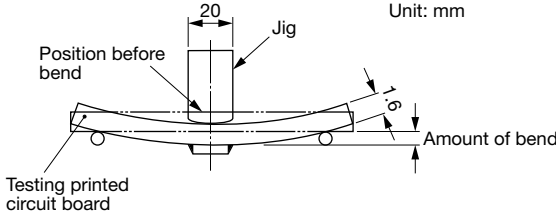
Note

- 0402 has no marking; 0603, 0805, 1206 marking shows two digits for resistance

DERATING


PERFORMANCES

| ENVIRONMENTAL PERFORMANCE | | | |
|---------------------------|---|---|--|
| NO. | ITEM | TEST CONDITION | SPECIFICATION |
| 1 | Short time overload | 5 times rated power for 5 seconds (JIS-C5202-5.5) | $\Delta R: \pm (1 \% + 0.0005 \Omega)$ |
| 2 | Temperature coefficient of resistance (TCR) | +25 °C / +125 °C (JIS-C5202-5.2) $TCR (ppm/^{\circ}C) = \frac{\Delta R}{R \times \Delta t} \times 10^6$ | Refer to Electrical Specification |
| 3 | Damp heat with load | The specimens shall be placed in a chamber and subjected to a relative humidity of 90 % to 95 % and a temperature of 40 °C \pm 2 °C for the period of 1000 hours with applying rated power 1.5 hours ON and 0.5 hour OFF. (MIL-STD-202, method 103) | $\Delta R: \pm (1 \% + 0.0005 \Omega)$ |
| 4 | High temperature exposure | The chip (mounted on board) is exposed in the heat chamber 125 °C \pm 3 °C for 1000 hours. (JIS-C5202-7.2) | $\Delta R: \pm (1 \% + 0.0005 \Omega)$ |
| 5 | Load life | Apply rated power at 70 °C \pm 2 °C for 1000 hours with 1.5 hours ON and 0.5 hour OFF. (JIS-C5202-7.10) | $\Delta R: \pm (1 \% + 0.0005 \Omega)$ |
| 6 | Rapid change of temperature | The chip (mounted on board) is exposed, -55 °C \pm 3 °C (30 min.) / +155 °C \pm 2 °C (30 min.) for 5 cycles. The following conditions as the following figure. (JIS-C5202-7.4)  | $\Delta R: \pm (1 \% + 0.0005 \Omega)$ |

| FUNCTION PERFORMANCE | | | |
|----------------------|---------------------------|---|---|
| NO. | ITEM | TEST CONDITION | SPECIFICATION |
| 1 | Bending strength | Mount the chip to test substrate. Apply pressure in direction of arrow unit band width reaches 2 mm (+0.2 / -0 mm) illustrated in the figure below and hold for 10 s \pm 1 s. (JIS-C5202-6.1)  | $\Delta R: \pm (1 \% + 0.0005 \Omega)$ |
| 2 | Solvent resistance | Complete immersion of specimens in isopropyl alcohol for 3 (+5, -0) min. 25 °C \pm 5 °C. (MIL-STD-202, method 215) | Verify marking permanency. (not required for laser etched parts or parts with no marking) |
| 3 | Resistance to solder heat | The specimen chip shall be immersed into the flux specified in the solder bath 260 °C \pm 5 °C for 10 s \pm 1 s. (MIL-STD-202, method 210) | $\Delta R: \pm (1 \% + 0.0005 \Omega)$ |

| FUNCTION PERFORMANCE | | | |
|----------------------|---------------|--|---|
| NO. | ITEM | TEST CONDITION | SPECIFICATION |
| 4 | Solderability | <p>The specimen chip shall be immersed into the flux specified in the solder bath $235\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ for $2\text{ s} \pm 0.5\text{ s}$. It shall be immersed to a point 10 mm from its root. (Sn96.5 / Ag3.0 / Cu0.5) (JIS-C5 202-6.11)</p> <p>$h = 10\text{ mm}$ $H = 10\text{ mm min.}$</p> | Solder shall be covered 95 % or more of the electrode area. |

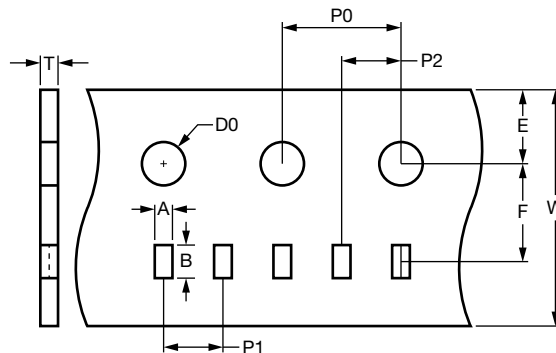
Notes

- 0.5 W with total solder pad trace size of 100 mm^2 . The surface temperature of component should below $100\text{ }^{\circ}\text{C}$
- 1.0 W with total solder pad trace size of 100 mm^2 . The surface temperature of component should below $100\text{ }^{\circ}\text{C}$

| TAPE PACKAGING SPECIFICATIONS | | | |
|---------------------------------|---------------------|-------------|-------------|
| MODEL | REEL | | |
| | TAPE WIDTH | DIAMETER | PIECES/REEL |
| WFC0402 | Embossed paper tape | 178 mm / 7" | 10 000 |
| WFC0603, WFC0805, WFC1206 | Embossed paper tape | 178 mm / 7" | 5000 |

Note

- Embossed carrier tape per EIA (EIAJ)

PAPER TAPE SPECIFICATIONS


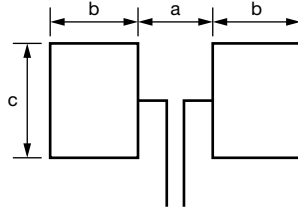
| TYPE | RESISTANCE RANGE | CARRIER DIMENSIONS (in millimeters) | | | | | | | | | |
|---------|----------------------------------|-------------------------------------|----------------|----------------|----------------|---------------|---------------|---------------|----------------|-----------------|----------------|
| | | A | B | E | F | W | P0 | P1 | P2 | D0 | T |
| WFC0402 | 3 m Ω to 50 m Ω | 0.7 ± 0.05 | 1.2 ± 0.05 | 1.75 ± 0.1 | 3.5 ± 0.05 | 8.0 ± 0.2 | 4.0 ± 0.1 | 2.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 0.6 ± 0.1 |
| WFC0603 | 1 m Ω to 5 m Ω | 1.4 ± 0.1 | 1.9 ± 0.1 | 1.75 ± 0.1 | 3.5 ± 0.05 | 8.0 ± 0.2 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 0.75 ± 0.1 |
| WFC0603 | 5.1 m Ω to 30 m Ω | 1.1 ± 0.1 | 1.9 ± 0.1 | 1.75 ± 0.1 | 3.5 ± 0.05 | 8.0 ± 0.2 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 0.70 ± 0.1 |
| WFC0805 | 1 m Ω to 5 m Ω | 2.4 ± 0.1 | 1.9 ± 0.1 | 1.75 ± 0.1 | 3.5 ± 0.05 | 8.0 ± 0.2 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 0.75 ± 0.1 |
| WFC0805 | 5.1 m Ω to 40 m Ω | 1.6 ± 0.1 | 2.4 ± 0.1 | 1.75 ± 0.1 | 3.5 ± 0.05 | 8.0 ± 0.2 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 0.97 ± 0.1 |
| WFC1206 | 1 m Ω to 3 m Ω | 2.0 ± 0.1 | 3.6 ± 0.1 | 1.75 ± 0.1 | 3.5 ± 0.05 | 8.0 ± 0.2 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 0.87 ± 0.1 |
| WFC1206 | 3.1 m Ω to 180 m Ω | 2.0 ± 0.1 | 3.6 ± 0.1 | 1.75 ± 0.1 | 3.5 ± 0.05 | 8.0 ± 0.2 | 4.0 ± 0.1 | 4.0 ± 0.1 | 2.0 ± 0.05 | 1.55 ± 0.05 | 0.97 ± 0.1 |

Notes

- Embossed carrier tape per EIA (EIAJ)
- Additional packaging details at www.vishay.com/doc?20051

STORAGE CONDITIONS

Temperature: 5 °C to 35 °C, humidity: 40 % to 75 %

RECOMMENDED SOLDER PAD LAYOUT


| TYPE | PAD LAYOUT DIMENSIONS (in millimeters) | | |
|-------------------------|--|------|------|
| | a | b | c |
| 0402 (3 mΩ to 7 mΩ) | 0.30 | 0.60 | 0.60 |
| 0402 (7.1 mΩ to 50 mΩ) | 0.50 | 0.50 | 0.60 |
| 0603 (1 mΩ to 5 mΩ) | 0.30 | 1.10 | 1.50 |
| 0603 (5.1 mΩ to 9 mΩ) | 0.60 | 0.90 | 1.00 |
| 0603 (9.1 mΩ to 30 mΩ) | 0.90 | 0.70 | 1.00 |
| 0805 (1 mΩ to 5 mΩ) | 0.80 | 1.60 | 1.45 |
| 0805 (5.1 mΩ to 40 mΩ) | 1.20 | 1.20 | 1.40 |
| 1206 (1 mΩ to 3 mΩ) | 0.40 | 1.80 | 2.20 |
| 1206 (3.1 mΩ to 180 mΩ) | 2.20 | 1.30 | 1.80 |

Note

- Recommend to use the steel plate which thickness > 100 μm to avoid the insufficient solder height

SOLDERING RECOMMENDATIONS

- Peak reflow temperatures and durations:
 - IR reflow peak = 260 °C max. for 10 s
 - Wave solder = 260 °C max. for 10 s
- Compatible with lead and lead (Pb)-free solder reflow processes
- Recommended IR reflow profile for surface mount devices: www.vishay.com/doc?31052



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