# THE DATASHEET OF

# CSR2512JTR100

Features:

- 0402 to 1225 sizes available
- Power ratings to 3W
- Low inductance – less than 0.2nH typically
- RoHS compliant and halogen-free
- Non-standard resistance values available
- 0815, 2010 and 2512 sizes available with narrow terminations (CSRN)

## Electrical Specifications - CSR

| Type / Code | Power Rating (Watts) @ 70ºC | Dielectric Withstanding Voltage | Resistance Temperature Coefficient | Ohmic Range (Ω) and Tolerance | |
|---|---|---|---|---|---|
| | | | | 1% | 2%, 5% |
| CSR0402 | 0.125W | 200V | ±200 ppm/ºC | 0.05 - 1 | |
| CSR0603 | 0.125W | 200V | ±300 ppm/ºC | 0.02 - 1 | |
| CSR0805 | 0.25W | 200V | ±200 ppm/ºC | 0.02 - 1 | |
| CSR1206 | 0.5W | 200V | ±100 ppm/ºC (1) | 0.01 - 1 | |
| CSR1210 | 0.5W | 200V | ±600 ppm/ºC | 0.01 - 0.02 | |
| | | | ±400 ppm/ºC | 0.021 - 0.05 | |
| | | | ±300 ppm/ºC | 0.051 - 0.099 | |
| | | | ±200 ppm/ºC | 0.1 - 1 | |
| CSR0830 | 2W | 200V | ±300 ppm/ºC | - | 0.001 - 0.004 |
| | | | ±200 ppm/ºC | 0.005 - 0.01 | |
| | | | ±150 ppm/ºC | 0.011 - 0.35 | |
| CSR2010 | 1W | 200V | ±100 ppm/ºC (1) | 0.01 - 1 | |
| CSR2512 | 2W | 200V | ±200 ppm/ºC | 0.01 - 1 | |
| CSR1225 | 3W | 200V | ±300 ppm/ºC | 0.003 - 0.005 | |
| | | | ±200 ppm/ºC | 0.006 - 0.02 | |
| | | | ±150 ppm/ºC | 0.021 - 0.03 | |
| | | | ±100 ppm/ºC | 0.033 - 8 | |

(1) Contact Factory for TCR below 50mOhm

## Electrical Specifications – CSRN (Narrow Termination)

| Type / Code | Power Rating (Watts) @ 70ºC | Dielectric Withstanding Voltage | Resistance Temperature Coefficient | Ohmic Range (Ω) and Tolerance | |
|---|---|---|---|---|---|
| | | | | 1% | 2%, 5% |
| CSRN0815 | 1W | 200V | ±300 ppm/ºC | 0.01 - 0.019 | |
| | | | ±150 ppm/ºC | 0.02 - 0.5 | |
| CSRN2010 | 1W | 200V | ±250 ppm/ºC | 0.01 - 1 | |
| CSRN2512(*) | 2W | 200V | ±200 ppm/ºC | 0.01 - 1 | |

(*) AEC-Q200 Qualified

## Electrical Specifications – CSR-HP (High Power)

| Type / Code | Power Rating (Watts) @ 70ºC | Dielectric Withstanding Voltage | Resistance Temperature Coefficient | Ohmic Range (Ω) and Tolerance |
|---|---|---|---|---|
| | | | | 1%, 2%, 5% |
| CSR0603…-HP | 0.2W | 200V | ±400 ppm/ºC | 0.051 - 0.1 |
| | | | ±300 ppm/ºC | 0.102 - 0.5 |
| | | | ±200 ppm/ºC | 0.51 - 1 |
| CSR1210…-HP | 0.75W | 200V | ±600 ppm/ºC | 0.01 - 0.02 |
| | | | ±400 ppm/ºC | 0.021 - 0.05 |
| | | | ±300 ppm/ºC | 0.051 - 0.091 |
| | | | ±200 ppm/ºC | 0.1 - 1 |

Please refer to the High Power Resistor Application Note (page 5) for more information on designing and implementing high power resistor types.



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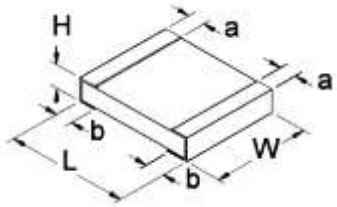
## Mechanical Specifications

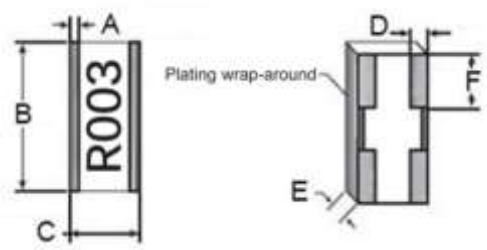



| Type / Code | L<br>Body Length | W<br>Body Width | H<br>Body Height | a<br>Top Termination | b<br>Bottom Termination | Unit |
|---|---|---|---|---|---|---|
| CSR0402 | 0.039 ± 0.002<br>1.00 ± 0.05 | 0.020 ± 0.002<br>0.50 ± 0.05 | 0.013 ± 0.004<br>0.32 ± 0.10 | 0.010 ± 0.004<br>0.25 ± 0.10 | 0.008 ± 0.004<br>0.20 ± 0.10 | inches<br>mm |
| CSR0603 | 0.063 ± 0.004<br>1.60 ± 0.10 | 0.031 ± 0.004<br>0.80 ± 0.10 | 0.018 ± 0.004<br>0.45 ± 0.10 | 0.012 ± 0.008<br>0.30 ± 0.20 | 0.012 ± 0.008<br>0.30 ± 0.20 | inches<br>mm |
| CSR0805 | 0.079 ± 0.006<br>2.00 ± 0.15 | 0.049 ± 0.006<br>1.25 ± 0.15 | 0.022 ± 0.004<br>0.55 ± 0.10 | 0.012 ± 0.008<br>0.30 ± 0.20 | 0.016 ± 0.010<br>0.40 ± 0.25 | inches<br>mm |
| CSR1206 | 0.120 ± 0.006<br>3.05 ± 0.15 | 0.061 ± 0.006<br>1.55 ± 0.15 | 0.022 ± 0.004<br>0.55 ± 0.10 | 0.020 ± 0.012<br>0.50 ± 0.30 | 0.016 ± 0.010<br>0.40 ± 0.25 | inches<br>mm |
| CSR1210 | 0.122 ± 0.004<br>3.10 ± 0.10 | 0.102 ± 0.006<br>2.60 ± 0.15 | 0.022 ± 0.004<br>0.55 ± 0.10 | 0.020 ± 0.012<br>0.50 ± 0.30 | 0.020 ± 0.010<br>0.50 ± 0.25 | inches<br>mm |
| CSR0830 | 0.079 ± 0.008<br>2.00 ± 0.20 | 0.295 ± 0.012<br>7.50 ± 0.30 | 0.024 ± 0.004<br>0.60 ± 0.10 | 0.016 ± 0.008<br>0.40 ± 0.20 | 0.016 ± 0.008<br>0.40 ± 0.20 | inches<br>mm |
| CSR2010 | 0.197 ± 0.008<br>5.00 ± 0.20 | 0.100 ± 0.008<br>2.54 ± 0.20 | 0.020 ± 0.006<br>0.50 ± 0.15 | 0.068 ± 0.006<br>1.72 ± 0.15 | 0.067 ± 0.006<br>1.70 ± 0.15 | inches<br>mm |
| CSR2512 | 0.252 ± 0.008<br>6.40 ± 0.20 | 0.126 ± 0.008<br>3.20 ± 0.20 | 0.020 ± 0.006<br>0.50 ± 0.15 | 0.075 ± 0.006<br>1.90 ± 0.15 | 0.075 ± 0.006<br>1.90 ± 0.15 | inches<br>mm |

## Mechanical Specifications – CSRN (Narrow Termination)

| Type / Code | L<br>Body Length | W<br>Body Width | H<br>Body Height | a<br>Top Termination | b<br>Bottom Termination | Unit |
|---|---|---|---|---|---|---|
| CSRN0815 | 0.079 ± 0.008<br>2.00 ± 0.20 | 0.148 ± 0.008<br>3.75 ± 0.20 | 0.024 ± 0.004<br>0.60 ± 0.10 | 0.016 ± 0.008<br>0.40 ± 0.20 | 0.016 ± 0.008<br>0.40 ± 0.20 | inches<br>mm |
| CSRN2010 | 0.197 ± 0.008<br>5.00 ± 0.20 | 0.096 ± 0.006<br>2.45 ± 0.15 | 0.024 ± 0.006<br>0.60 ± 0.15 | 0.024 ± 0.012<br>0.60 ± 0.30 | 0.020 ± 0.010<br>0.50 ± 0.25 | inches<br>mm |
| CSRN2512 | 0.250 ± 0.008<br>6.35 ± 0.20 | 0.124 ± 0.006<br>3.15 ± 0.15 | 0.024 ± 0.004<br>0.60 ± 0.10 | 0.024 ± 0.012<br>0.60 ± 0.30 | 0.022 ± 0.010<br>0.55 ± 0.25 | inches<br>mm |

## Mechanical Specifications – CSR1225




| Type / Code | A | B | C | D | E | F | Unit |
|---|---|---|---|---|---|---|---|
| CSR1225 | 0.024 ± 0.012<br>0.60 ± 0.30 | 0.254 ± 0.006<br>6.45 ± 0.15 | 0.126 ± 0.006<br>3.20 ± 0.15 | 0.031 ± 0.010<br>0.80 ± 0.25 | 0.035 ± 0.006<br>0.90 ± 0.15 | 0.090 ± 0.005<br>2.29 ± 0.13 | inches<br>mm |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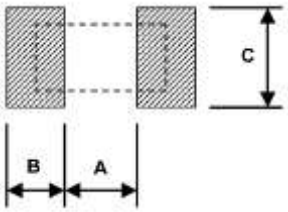
## Recommended Pad Layouts - CSR




| Type / Code | A | B | C | Unit |
|---|---|---|---|---|
| CSR0402 | 0.020<br>0.50 | 0.020<br>0.50 | 0.024 ± 0.008<br>0.60 ± 0.20 | inches<br>mm |
| CSR0603 | 0.031<br>0.80 | 0.039<br>1.00 | 0.035 ± 0.008<br>0.90 ± 0.20 | inches<br>mm |
| CSR0805 | 0.039<br>1.00 | 0.039<br>1.00 | 0.053 ± 0.008<br>1.35 ± 0.20 | inches<br>mm |
| CSR1206 | 0.079<br>2.00 | 0.045<br>1.15 | 0.067 ± 0.008<br>1.70 ± 0.20 | inches<br>mm |
| CSR1210 | 0.079<br>2.00 | 0.045<br>1.15 | 0.098 ± 0.008<br>2.50 ± 0.20 | inches<br>mm |
| CSR0830 | 0.039<br>1.00 | 0.071<br>1.80 | 0.299 ± 0.008<br>7.60 ± 0.20 | inches<br>mm |
| CSR2010 | 0.142<br>3.60 | 0.055<br>1.40 | 0.098 ± 0.008<br>2.50 ± 0.20 | inches<br>mm |
| CSR2512 | 0.193<br>4.90 | 0.063<br>1.60 | 0.126 ± 0.008<br>3.20 ± 0.20 | inches<br>mm |
| CSR1225 | 0.047<br>1.20 | 0.079<br>2.00 | 0.276 ± 0.008<br>7.00 ± 0.20 | inches<br>mm |

## Recommended Pad Layouts - CSRN

| Type / Code | A | B | C | Unit |
|---|---|---|---|---|
| CSRN0815 | 0.039<br>1.00 | 0.071<br>1.80 | 0.154 ± 0.008<br>3.90 ± 0.20 | inches<br>mm |
| CSRN2010 | 0.142<br>3.60 | 0.055<br>1.40 | 0.098 ± 0.008<br>2.50 ± 0.20 | inches<br>mm |
| CSRN2512 | 0.193<br>4.90 | 0.063<br>1.60 | 0.126 ± 0.008<br>3.20 ± 0.20 | inches<br>mm |

## Performance Characteristics

| Test | Test Method | Test Specification | Typical | Test Condition |
|---|---|---|---|---|
| High Temperature Exposure | MIL-STD-202 Method 108 | 1% Tol: (±1.0% +0.05Ω)<br>2%, 5% Tol:(±1.5% +0.10Ω) | ≤ 0.5% | 1000 hrs. @ T=155°C. Unpowered. Measurement at 24 ± 4 hours after test conclusion. |
| Short Time Overload | JIS-C-5201-1 4.13<br>IEC 60115-1 4.13 | ±(0.5% +0.05Ω) | ≤ 0.25% | RCV(rated current)*2.5 for 5 seconds. |
| | | ±(1.0% +0.05Ω)<br>For high power rating | ≤ 0.5% | |
| Temperature Cycling | JESD22 Method JA-104 | 1% Tol: (±0.5% +0.05Ω)<br>2%, 5% Tol:(±1.5% +0.10Ω) | ≤ 0.5% | 1000 Cycles (-55°C to +125°C) Measurement at 24 ± 4 hours after test conclusion.<br>30 min maximum dwell time at each temperature extreme. 1 min. maximum transition time. |
| Biased Humidity | MIL-STD-202 Method 103 | 1% Tol: (±1.00% +0.10Ω)<br>2%, 5% Tol:(±2.00% +0.10Ω) | ≤ 0.5% | 1000 hours 85°C/85% RH. Note: Specified conditions: 10% of operating power. Measurement at 24 ± 4 hours after test conclusion. |
| Operational Life | MIL-STD-202 Method 108 | 1% Tol: (±1.00% +0.10Ω)<br>2%, 5% Tol:(±2.00% +0.10Ω) | ≤ 0.5% | Condition D Steady State $T_A$=125°C at rated power. Measurement at 24 ± 4 hours after test conclusion. |
| External Visual | MIL-STD 883 Method 2009 | -- | Pass | Electrical test not required. Inspect device construction, marking and workmanship. |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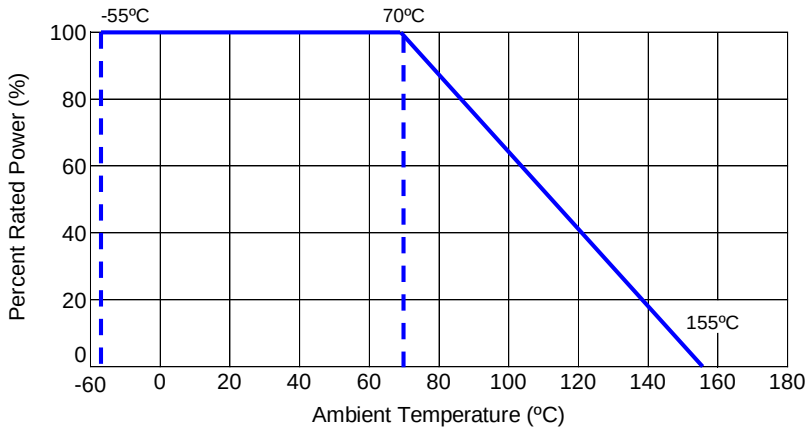
| Performance Characteristics (cont.) | | | | |
|---|---|---|---|---|
| Test | Test Method | Test Specification | Typical | Test Condition |
| Physical Dimensions | JESD22 Method JB-100 | -- | Pass | Verify physical dimensions to the applicable device detail specification. Note: User(s) and Suppliers spec. Electrical test not required. |
| Resistance to Solvents | MIL-STD 202 Method 215 | Marking unsmeared | Pass | Note: Aqueous wash chemical - OKEM Clean or equivalent. Do not use banned solvents. |
| Mechanical Shock | MIL-STD 202 Method 213 | 1% Tol: (±0.25% +0.05Ω)<br>2%, 5% Tol:(±1.00% +0.05Ω) | ≤ 0.5% | Figure 1 of Method 213. Condition C. |
| Vibration | MIL-STD 202 Method 204 | 1% Tol: (±0.50% +0.05Ω)<br>2%, 5% Tol:(±1.00% +0.05Ω) | ≤ 0.5% | 5 g's for 20 min., 12 cycles each of 3 orientations. Note: Use 8"X5" PCB 0.031" thick 7 secure points on one long side and 2 secure points at corners of opposite sides. Parts mounted within 2" from any secure point. Test from 10 - 2000 Hz. |
| Resistance to Soldering Heat | MIL-STD 202 Method 210 | 1% Tol: (±0.50% +0.05Ω)<br>2%, 5% Tol:(±1.00% +0.05Ω) | ≤ 0.5% | Condition B no pre-heat of samples. Note: Single wave solder - Procedure 2 for SMD. |
| ESD | AEC-Q200-002 | -- | Pass | With the electrometer in direct contact with the discharge tip, verify the voltage setting at levels of ±500 V, ±1kV, ±2kV, ±4kV, ±8kV.<br>The electrometer reading shall be within ±10% for voltages from 500 V to ≤ 8 kV. |
| Solderability | J-STD-002 | > 95% Coverage | Pass | Electrical test not required. Magnification 50X.<br>Conditions:<br>SMD:<br>a) Method B, 4 hrs @ 155°C dry heat @ 235°C.<br>b) Method B @ 215°C category 3.<br>c) Method D category 3 @ 260°C. |
| Electrical Characterization | User Spec | -- | Pass | Parametrically test per lot and sample size requirements, summary to show Min, Max, Mean and Standard Deviation at room as well as Min and Max operating temperatures. |
| Flammability | UL-94 | No ignition of tissue or scorching of pine board. | Pass | V-0 or V-1 are acceptable.<br>Electrical test not required. |
| Board Flex | AEC-Q200-005 | 1% Tol: (±1.00% +0.05Ω)<br>2%, 5% Tol:(±1.00% +0.05Ω) | ≤ 0.5% | 60 second minimum holding time. |
| Terminal Strength (SMD) | AEC-Q200-006 | None broken | Pass | |
| Flame Retardance | AEC-Q200-001 | No flame | Pass | |

Operating Temperature Range: -55ºC to +155ºC

## Power Derating Curve:





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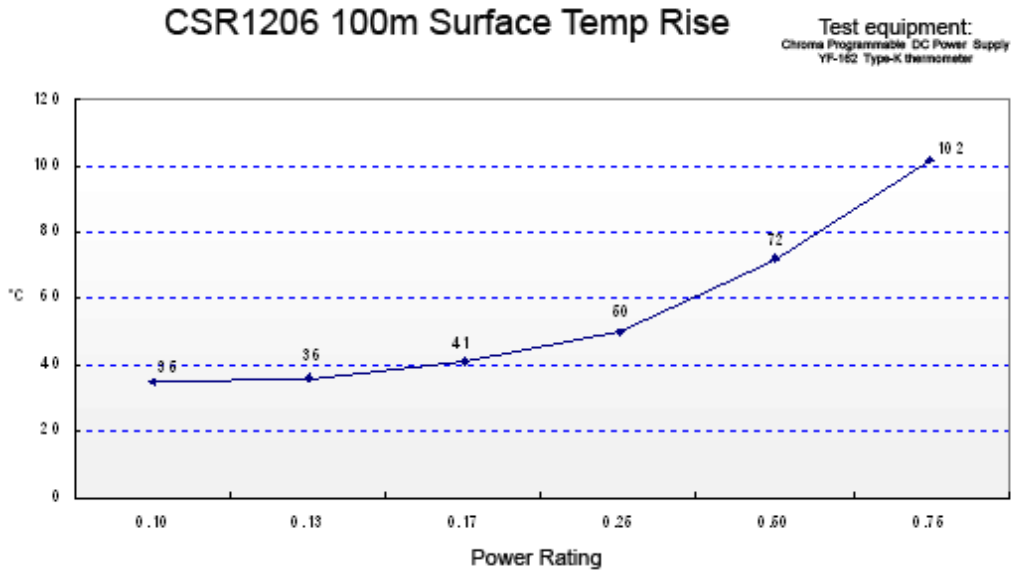
## High Power Chip Resistors and Thermal Management

Stackpole has developed several surface mount resistor series in addition to our current sense resistors, which have had higher power ratings than standard resistor chips. This has caused some uncertainty and even confusion by users as to how to reliably use these resistors at the higher power ratings in their designs.

The data sheets for the RHC, RMCP, RNCP, CSR, CSRN, CSRF, CSS, and CSSH state that the rated power assumes an ambient temperature of no more than 100°C for the CSS / CSSH series and 70°C for all other high power resistor series. In addition, IPC and UL best practices dictate that the combined temperature on any resistor due to power dissipated and ambient air shall be no more than 105°C. At first glance this wouldn't seem too difficult, however the graph below shows typical heat rise for the CSR ½ 100 milliohm at full rated power. The heat rise for the RMCP and RNCP would be similar. The RHC with its unique materials, design, and processes would have less heat rise and therefore would be easier to implement for any given customer.




The 102°C heat rise shown here would indicate there will be additional thermal reduction techniques needed to keep this part under 105°C total hot spot temperature if this part is to be used at 0.75 watts of power. However, this same part at the usual power rating for this size would have a heat rise of around 72°C. This additional heat rise may be dealt with using wider conductor traces, larger solder pads and land patterns under the solder mask, heavier copper in the conductors, via through PCB, air movement, and heat sinks, among many other techniques. Because of the variety of methods customers can use to lower the effective heat rise of the circuit, resistor manufacturers simply specify power ratings with the limitations on ambient air temperature and total hot spot temperatures and leave the details of how to best accomplish this to the design engineers. Design guidelines for products in various market segments can vary widely so it would be unnecessarily constraining for a resistor manufacturer to recommend the use of any of these methods over another.

Note: The final resistance value can be affected by the board layout and assembly process, especially the size of the mounting pads and the amount of solder used. This is especially notable for resistance values ≤ 50mΩ. This should be taken into account when designing.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## RoHS Compliance

Stackpole Electronics has joined the worldwide effort to reduce the amount of lead in electronic components and to meet the various regulatory requirements now prevalent, such as the European Union's directive regarding "Restrictions on Hazardous Substances" (RoHS 3). As part of this ongoing program, we periodically update this document with the status regarding the availability of our compliant components. All our standard part numbers are compliant to EU Directive 2011/65/EU of the European Parliament as amended by Directive (EU) 2015/863/EU as regards the list of restricted substances.

**RoHS Compliance Status**

| Standard Product Series | Description | Package / Termination Type | Standard Series RoHS Compliant | Lead-Free Termination Composition | Lead-Free Mfg. Effective Date (Std Product Series) | Lead-Free Effective Date Code (YY/WW) |
|---|---|---|---|---|---|---|
| CSR | Thick Film Current Sensing Surface Mount Chip Resistor | SMD | YES by means of exemption 7c-I | 100% Matte Sn over Ni | May-04 | 04/18 |
| CSRN | Thick Film Current Sensing Surface Mount Chip Resistor, Narrow | SMD | YES by means of exemption 7c-I | 100% Matte Sn over Ni | May-04 | 04/18 |

## "Conflict Metals" Commitment

We at Stackpole Electronics, Inc. are joined with our industry in opposing the use of metals mined in the "conflict region" of the eastern Democratic Republic of the Congo (DRC) in our products. Recognizing that the supply chain for metals used in the electronics industry is very complex, we work closely with our own suppliers to verify to the extent possible that the materials and products we supply do not contain metals sourced from this conflict region. As such, we are in compliance with the requirements of Dodd-Frank Act regarding Conflict Minerals.

## Compliance to "REACH"

We certify that all passive components supplied by Stackpole Electronics, Inc. are SVHC (Substances of Very High Concern) free and compliant with the requirements of EU Directive 1907/2006/EC, "The Registration, Evaluation, Authorization and Restriction of Chemicals", otherwise referred to as REACH. Contact us for complete list of REACH Substance Candidate List.

## Environmental Policy

It is the policy of Stackpole Electronics, Inc. (SEI) to protect the environment in all localities in which we operate. We continually strive to improve our effect on the environment. We observe all applicable laws and regulations regarding the protection of our environment and all requests related to the environment to which we have agreed. We are committed to the prevention of all forms of pollution.

**How to Order**

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | S | R | 1 | 2 | 0 | 6 | F | T | 1 | 0 | L | 0 | - | H | P |

**Product Series**

| Code | Description |
|---|---|
| CSR | Standard |
| CSRN | Narrow Terminations |

**Size**

| Code | Power |
|---|---|
| 0402 | 0.125W |
| 0603 | 0.125W |
| 0805 | 0.25W |
| 1206 | 0.5W |
| 1210 | 0.5W |
| 0815 | 1W |
| 0830 | 2W |
| 2010 | 1W |
| 2512 | 2W |
| 1225 | 3W |

**Tolerance**

| Code | Tol |
|---|---|
| F | 1% |
| G | 2% |
| J | 5% |

**Packaging**

| Code | Description | Size | Quantity |
|---|---|---|---|
| T | 7" Reel Paper Tape | 0402 | 10,000 |
| | | 0603, 0805, 1206, 1210 | 5,000 |
| | 7" Reel Plastic Tape | 2010, 2512 | 4,000 |
| | | 0815, 0830, 1225 | 2,000 |
| K | 7" Reel Paper Tape | 0402 | 1,000 |
| | | 0603, 0805, 1206, 1210 | |
| | 7" Reel Plastic Tape | 2010, 2512 | |
| | | 0815, 0830, 1225 | |

**Resistance Value**

Four characters with the multiplier used as the decimal holder.
"L" used as multiplier of $10^{-3}$ for any value under 0.1 ohm

0.051 ohm = 51L0
0.35 ohm = R350
1 ohm = 1R00

**Special (*)**

| Code | Description |
|---|---|
| -HP | High Power |

(*) Only available for 0603 and 1210 sizes



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