Mission-critical resistor specialists.

State of the Art

State of the Art, Inc.
MISSION-CRITICAL RESISTOR SPECIALISTS.
All products are made in the USA.
Market/Products

We have been supplying the aerospace, biomedical, defense, and communications industries with high reliability, mission-critical chip resistors for over 40 years. All of our products are designed and manufactured with performance and reliability as the guiding principles. Our other products include:

- Thin film on silicon resistors for hybrid applications
- High frequency products, including attenuators, terminations, and chip resistors
- Surface mount resistor networks and custom thick and thin film networks
- High power resistors on beryllia or aluminum nitride
- Special application resistors including high voltage, high value, power moisture, and current sensing

Customer Service

Outstanding customer service is just as important as the quality of the product. State of the Art, Inc. delivers that extra level of service for every customer, offering:

- Application-specific engineering assistance
- A large inventory of ready-to-ship resistors for rapid delivery
- Well-trained, knowledgeable sales staff
- Best-in-class packaging and documentation

From accurate, timely quotations to the packaging and documentation that accompanies the product, you will appreciate the State of the Art, Inc. advantage.

History

State of the Art, Inc. was founded in 1969 as a business presenting short courses on thick film processing. We began manufacturing chip resistors in 1972 and our products have been used in mission-critical space and military programs since 1975. We have been qualified to supply MIL-PRF-55342 film chip resistors since 1980.

Our comprehensive line of resistor products and our uncompromising dedication to quality, reliability, and customer service have established State of the Art, Inc.’s worldwide reputation as a leading supplier of chip resistors for mission-critical applications.

All of our resistor products are made in the USA at our State College, Pennsylvania facility. We use the same design, materials, quality systems, and production line to produce our standard, high reliability, and QPL military products. All of our products are designed for reliability in demanding applications. State of the Art, Inc. remains a privately held and financially strong manufacturer dedicated to serving the high reliability market.

<table>
<thead>
<tr>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Military Products</td>
</tr>
<tr>
<td>6 High Reliability Products</td>
</tr>
<tr>
<td>8 Standard and High Reliability Chip Resistors</td>
</tr>
<tr>
<td>10 Chip Resistors for Hybrids</td>
</tr>
<tr>
<td>12 High Frequency Resistors</td>
</tr>
<tr>
<td>13 Attenuators</td>
</tr>
<tr>
<td>14 Special Application Chip Resistors</td>
</tr>
<tr>
<td>16 Resistor Networks</td>
</tr>
<tr>
<td>17 Resistor Performance</td>
</tr>
<tr>
<td>20 Ordering Information</td>
</tr>
</tbody>
</table>
Quality Systems

Our ISO 9001 and AS9100 registered quality systems, MIL-PRF-55342, MIL-PRF-32159, and MIL-PRF-914 QPL qualifications, and long-standing continuous improvement philosophy attest to our commitment to manufacturing the highest reliability resistor and attenuator products.

<table>
<thead>
<tr>
<th>Quality Systems</th>
<th>ISO 9001 &amp; AS9100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reliability Assurance</td>
<td>MIL-STD-790</td>
</tr>
<tr>
<td>Failure Rate Procedures</td>
<td>MIL-STD-690</td>
</tr>
<tr>
<td>Defect Level (ppm)</td>
<td>EIA-554</td>
</tr>
<tr>
<td>Statistical Process Control</td>
<td>EIA-557</td>
</tr>
<tr>
<td>Calibration System</td>
<td>ISO 10012</td>
</tr>
</tbody>
</table>

Product Grades

State of the Art, Inc. offers military, high reliability, and standard grade products that share the same design, materials, quality system, and production line. All of our products are subject to a quality system designed to meet the rigors of supplying established reliability military chip resistors. Military, high reliability, and standard grade products are identical except for the extent of screening performed.

**Military Grade** Our MIL-PRF-55342 chip resistors are subject to in-process inspections and Group A, B, and C lot acceptance testing. MIL-PRF-55342 resistors are maintained at S failure rate level on the basis of life testing. State of the Art, Inc. is listed on the QPL55342 (fixed chip resistors) for all product levels (M, P, R, S, U, V, and space level T) and all 13 slash sheets. Similarly, we are listed on QPL32159 (zero ohm chip resistors) for product levels M and space level T and all 13 slash sheets. We are also listed on QPL914 (surface mount resistor networks) for the /03, /04, and /05 slash sheets.

**High Reliability Grade** High reliability products are used in mission-critical applications where QPL products are not available or are not adequate. High reliability products include DLA Land and Maritime drawings, customer source control drawings, and our own test protocols based on MIL-PRF-55342 created for our customers’ convenience. Most of the high reliability screening we perform is based upon the lot acceptance testing of MIL-PRF-55342.

**Standard Grade** Standard grade resistors are ideal for non-mission-critical applications. These products are designed for reliability and only differ from our military products in the screening performed. Our standard grade products are subject to DC resistance on a 100% basis, and solderability, temperature coefficient of resistance, and visual inspection on a sample basis during manufacturing. Standard grade resistors are not subject to any lot acceptance testing.
MIL-PRF-55342 Chip Resistors

MIL-PRF-55342 provides established reliability for fixed film chip resistors in a variety of cases, product levels, temperature characteristics, tolerances, and termination materials.

MIL-PRF-55342 includes precision and semi-precision part numbers that use thick film and thin film materials and processes to provide the complete range of part numbers.

Precision thin film chip resistors have resistance tolerances of ±0.1, ±0.25, and ±0.5% and/or temperature coefficient of resistance of ±25 and ±50 ppm/°C. Thin film materials are sputter deposited and patterned using photolithography. These thin film resistor materials exhibit low current noise and lower drift than semi-precision thick film resistors.

Semi-precision thick film devices have resistance tolerances of ±1, ±2, ±5, and ±10% and/or temperature coefficient of resistance of ±100, ±200, and ±300 ppm/°C. Thick film pastes are screen printed onto alumina substrates and fired at 850°C. These thick film resistors have higher current capacity than precision thin film resistors.

Surface Mount Chip Resistors
Precision and semi-precision chip resistors with termination material B are assembled using surface mount tin-lead soldering processes. Termination material B devices have wraparound terminations with SN60 solder over a nickel barrier layer.

Chip Resistors for Hybrids
Chip resistors with termination materials C (silver based), G (gold), and U (platinum gold) are assembled into hybrid circuits using conductive epoxy. These semi-precision thick film chip resistors have wraparound terminations which are not solderable.

Precision and semi-precision chip resistors with termination material W are also assembled into hybrid circuits using wire bonds. These devices have planar terminations on the top surface of the resistor with a gold finish.

### Cases and Ratings

<table>
<thead>
<tr>
<th>Case Size Code*</th>
<th>Rated Power (mW)</th>
<th>Rated Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M55342/13</td>
<td>RM0302</td>
<td>40</td>
</tr>
<tr>
<td>M55342/11</td>
<td>RM0402</td>
<td>50</td>
</tr>
<tr>
<td>M55342/01</td>
<td>RM0502</td>
<td>50</td>
</tr>
<tr>
<td>M55342/02</td>
<td>RM0505</td>
<td>125</td>
</tr>
<tr>
<td>M55342/12</td>
<td>RM0603</td>
<td>100</td>
</tr>
<tr>
<td>M55342/06</td>
<td>RM0705</td>
<td>150</td>
</tr>
<tr>
<td>M55342/03</td>
<td>RM1005</td>
<td>200</td>
</tr>
<tr>
<td>M55342/07</td>
<td>RM1206</td>
<td>250</td>
</tr>
<tr>
<td>M55342/04</td>
<td>RM1505</td>
<td>150</td>
</tr>
<tr>
<td>M55342/10</td>
<td>RM1010</td>
<td>500</td>
</tr>
<tr>
<td>M55342/08</td>
<td>RM2010</td>
<td>800</td>
</tr>
<tr>
<td>M55342/05</td>
<td>RM2208</td>
<td>225</td>
</tr>
<tr>
<td>M55342/09</td>
<td>RM2512</td>
<td>1000</td>
</tr>
</tbody>
</table>

*Case size code indicates nominal part size. Example: RM0402 is 40 x 20 mils.
Product Levels
All product levels share the same design, materials, and construction processes. Product levels only differ in the conformance inspection performed in Groups A and B.

Product levels M, P, R, and S resistors are subject to precap visual inspection and 100% DC resistance on a production lot basis. Thermal shock and solderability have been deleted with qualifying activity approval. Visual inspection, resistance to solvents, and all of Group B are performed on an inspection lot basis.

Product levels U and V subjects R and S level resistors to Group B on a production lot basis.

Space product level T subjects R and S level resistors to Groups A and B testing on a production lot basis. Power conditioning and visual inspection (100%) are added to Group A, subgroup 2, to provide infant mortality screening.

Group C is performed on an inspection lot basis for all product levels.

M55342 K 06 B 100D S

<table>
<thead>
<tr>
<th>Product Level Designation</th>
<th>R &amp; U: 0.01% per 1000 hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>M: 1% per 1000 hrs</td>
<td>S &amp; V: 0.001% per 1000 hrs</td>
</tr>
<tr>
<td>P: 0.1% per 1000 hrs</td>
<td>T: Space Level</td>
</tr>
<tr>
<td>Resistance &amp; Tolerance Code</td>
<td>Three significant digits, with a letter indicating the decimal location, the tolerance, and the value range (Ω, kΩ, MΩ)</td>
</tr>
<tr>
<td>0.1%</td>
<td>0.25%</td>
</tr>
<tr>
<td>0.5%</td>
<td>1%</td>
</tr>
<tr>
<td>2%</td>
<td>5%</td>
</tr>
<tr>
<td>10%</td>
<td>Ω: A R W D G J M</td>
</tr>
<tr>
<td>kΩ: B U Y E H K N</td>
<td>MΩ: C V Z F T L P</td>
</tr>
<tr>
<td>Termination Materials</td>
<td>B: SN60 solder over nickel barrier wraparound</td>
</tr>
<tr>
<td>C: Epoxy bondable palladium/silver wraparound (thick film only)</td>
<td></td>
</tr>
<tr>
<td>U: Epoxy bondable platinum/gold wraparound (thick film only)</td>
<td></td>
</tr>
<tr>
<td>W: Gold wire bondable G: Epoxy bondable gold wraparound (thick film only)</td>
<td></td>
</tr>
<tr>
<td>Size Code</td>
<td>01: RM0502 04: RM1505 06: RM0705 08: RM2010 10: RM1010 12: RM0603</td>
</tr>
<tr>
<td></td>
<td>02: RM0505 05: RM2208 07: RM1206 09: RM2512 11: RM0402 13: RM0302 03: RM1008</td>
</tr>
<tr>
<td>Temperature Characteristic</td>
<td>E: ±25 ppm H: ±50 ppm K: ±100 ppm M: ±300 ppm L: ±200 ppm</td>
</tr>
</tbody>
</table>

Performance Specification MIL-PRF-55342

Packaging
MIL-PRF-55342 devices are packaged in waffle trays or on tape and reel, and may be indicated by using -W or -TR after the part number.
MIL-PRF-32159 provides zero ohm chip resistors in a variety of cases, product levels, and termination materials suitable for soldering, wire bonding, and epoxy bonding applications.

Surface Mount Zero Ohm Chip Resistors
Zero ohm chip resistors with termination material B are assembled using surface mount tin-lead soldering processes. Termination material B devices have wraparound terminations with SN60 solder over nickel barrier.

Zero Ohm Chip Resistors for Hybrids
Zero ohm chip resistors with termination materials C (silver based), G (gold), and U (platinum gold) are assembled into hybrid circuits using conductive epoxy. These termination materials have wraparound terminations which are not solderable.

Product Levels
All product levels share the same design, materials, and construction processes. The product levels differ in the conformance inspection testing performed in Groups A and B. Group C is performed on an inspection lot basis for all product levels. MIL-PRF-32159 devices do not have an established reliability failure rate level.

Military product level M zero ohm chip resistors are subject to precap visual inspection and 100% DC resistance on a production lot basis. Thermal shock and solderability have been deleted with qualifying activity approval. Visual inspection, resistance to solvents, and all of Group B are performed on an inspection lot basis.

Space product level T subjects M level zero ohm resistors to Groups A and B on a production lot basis with no deletions. Power conditioning and visual inspection (100%) are added to Group A, subgroup 2, to provide infant mortality screening.
MIL-PRF-914 Surface Mount Resistor Networks

MIL-PRF-914 surface mount resistor networks are available in three sizes and with three schematics each.

MIL-PRF-914 provides product level M, which is maintained at an established reliability rating of 1%/1000 hours. Group A includes 100% thermal shock, 100% power conditioning, and 100% DC resistance performed on a production lot basis. Visual inspection and solderability are performed on an inspection lot basis. Group B and Group C are performed on an inspection lot basis. The inclusion of 100% power conditioning in MIL-PRF-914’s Group A inspection mimics the space level infant mortality screening found in MIL-PRF-55342.

MIL-PRF-914 includes two termination materials with similar tin-lead solder over nickel materials. Termination material D is electroplated SN60 solder over nickel barrier. Termination material G is made by immersing devices with the D material into molten SN60 solder (hot solder dip finish).

MIL-PRF-914 Screening

**Group A**
- 100% Thermal Shock
- 100% Power Conditioning
- 100% DC Resistance
- Visual Inspection
- Solderability

**Group B**
- Visual & Mechanical Inspection
- Temperature Coefficient of Resistance (TCR)
- Resistance to Solvents

**Group C**
- Thermal Shock
- Dielectric Withstanding Voltage
- Insulation Resistance
- Low Temperature Operation
- Short-time Overload
- Adhesion
- Resistance to Soldering Heat
- Moisture Resistance
- Life
- Steady State Humidity
- Shock & Vibration
- High Temperature Exposure
- Low Temperature Storage

Packaging

SOTA’s surface mount resistor networks are packaged in chip tray carriers (“waffle packs”). Tape and reel packaging is available as an option for the /04 and /05 MIL-PRF-914 networks.

Part Marking

**Line 1**
- Digits 1-3: Date code.
  - Digit 1 = year.
  - Digits 2 & 3 = week.
- Digit 4 = TCR.

**Line 2**
- Digits 1-4: Resistance value.
  - Three significant digits and multiplier.

**Line 3**
- Digit 1: Tolerance.
- Digit 2: Schematic configuration.
- Digit 3: Failure rate.
- Digit 4: Military JAN certification.

A dot is used to mark the pin one location.
High reliability screening is available for all of our products.

High reliability screening can be used to identify anomalous lots with excessive drift that could threaten the success of your mission. High reliability screening is typically specified using a customer source control drawing, a DLA Land and Maritime (DESC, DSCC, etc.) drawing, or a State of the Art, Inc. screening drawing. High reliability screening is often based upon the lot acceptance testing of MIL-PRF-55342.

Customer Source Control Drawings
Source control drawings are created by customers to communicate the performance requirements for devices used in their application. These drawings often use MIL-PRF-55342 screening methods but can add additional requirements, additional tests, and custom test criteria. We welcome the opportunity to review your SCD.

DLA Land and Maritime Drawings
Our high reliability products also include many DLA Land and Maritime, DESC, and DSCC drawings for high reliability chip resistor and surface mount resistor networks. These drawings include various chip resistors and resistor networks not included in MIL-PRF-55342 and MIL-PRF-914. Please consult your sales contact for more information on these drawing products.

- Values < 1 Ω
- Zero Ohm Chips
- Power Moisture Resistors
- Non-QPL Case Sizes
- High Power Resistors
- Surface Mount Resistor Networks

Consult DLA Land and Maritime for more specific information on these DESC, DSCC, and DLA Land and Maritime drawings.
State of the Art, Inc. Test Drawings
Our test drawings specify screening, sampling plans, test methods, and pass/fail criteria. These drawings are based upon the lot acceptance testing of MIL-PRF-55342 and may be adapted to meet the needs of particular products (silicon resistors, high power resistors, etc.).

Test Drawings

<table>
<thead>
<tr>
<th>Test Drawings</th>
<th>Description</th>
</tr>
</thead>
</table>
| **Groups A & B per MIL-PRF-55342 Military Levels** | SOTA 001  
SOTA 014 attenuators  
SOTA 006 (+ 100% visual inspection)  
SOTA 021 (+ 1000 hour life test) |
| **Groups A & B per MIL-PRF-55342 Space Level T 100% power conditioning** | SOTA 002  
100% high temperature (125°C) exposure  
SOTA 004  
SOTA 015 attenuators |
| **Groups A, B & C MIL-PRF-55342 Military Levels** | SOTA 036  
SOTA 042 attenuators |
| **Groups A, B & C MIL-PRF-55342 Military Levels and Sample power conditioning** | SOTA 007  
SOTA 008 (+100% visual inspection) |
| **Group A per MIL-PRF-55342 Military Levels** | SOTA 013 |
| **Group C per MIL-PRF-55342** | SOTA 000  
SOTA 016 attenuators |
| **Life Test** | SOTA 022 1000 hours  
SOTA 033 2000 hours |
| **Element Evaluation per MIL-PRF-38534** | SOTA 023 Class H  
SOTA 024 Class K |
| **EEE-INST-002** | SOTA 031 Level 1  
SOTA 040 Level 2  
SOTA 043 Level 3 |
| **Recertification of older date code product** | SOTA 020 DC Resistance and Solderability |

**MIL-PRF-55342 Military Levels**

**Group A**
- Precap Visual Inspection
- Thermal Shock (100%)
- DC Resistance (100%)
- Visual Inspection
- Solderability
- Resistance to Solvents

**Group B**
- Resistance Temperature Characteristic
- Short Time Overload
- Mounting Integrity

**MIL-PRF-55342 Space Level T**

**Group A**
- Precap Visual Inspection
- DC Resistance (100%)
- Thermal Shock (100%)
- Power Conditioning (100%)
- DC Resistance (100%)
- Visual Inspection (100%)
- Visual Inspection
- Solderability
- Resistance to Solvents

**Group B**
- Resistance Temperature Characteristic
- Short Time Overload
- Mounting Integrity

**MIL-PRF-55342**

**Group C**
- Life
- Thermal Shock
- Low Temperature Operation
- Resistance to Soldering Heat or Resistance to Bonding Exposure
- Moisture Resistance
- High Temperature Exposure
Surface Mount
Semi-Precision Thick Film

Semi-precision thick film chip resistors are available in a wide range of resistance values with tolerances to 1% and temperature coefficient of resistance (TCR) to 100 ppm/°C.

Semi-precision thick film chip resistors are available with resistance values from 20 mΩ to 300 MΩ. Thick film resistors have higher current capacity than the precision thin film resistors. Low resistance value devices have low current noise, but current noise increases with resistance value.

Wraparound terminations (C type) with the X finish (SN60 solder over nickel barrier) are used for surface mount applications using tin-lead based solders. The Y finish (silver over nickel barrier) is offered for use with RoHS solder alloys.

Other termination types and finishes are offered for other applications. Wire bond applications use A, D, or E termination types with a gold (G) finish. Epoxy bondable applications use C termination type with silver (C), gold (G), or platinum gold (P) finish for use with conductive epoxies.

<table>
<thead>
<tr>
<th>Case Size Code*</th>
<th>Rated Power (mW)</th>
<th>Rated Voltage (V)</th>
<th>Thermal Resistance (˚C/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0302</td>
<td>40</td>
<td>15</td>
<td>56.0</td>
</tr>
<tr>
<td>0402</td>
<td>50</td>
<td>30</td>
<td>48.9</td>
</tr>
<tr>
<td>0502</td>
<td>60</td>
<td>40</td>
<td>36.8</td>
</tr>
<tr>
<td>0504</td>
<td>125</td>
<td>40</td>
<td>29.0</td>
</tr>
<tr>
<td>0505</td>
<td>125</td>
<td>40</td>
<td>20.9</td>
</tr>
<tr>
<td>0603</td>
<td>100</td>
<td>50</td>
<td>30.5</td>
</tr>
<tr>
<td>0705</td>
<td>200</td>
<td>50</td>
<td>23.7</td>
</tr>
<tr>
<td>1005</td>
<td>250</td>
<td>75</td>
<td>26.9</td>
</tr>
<tr>
<td>1010</td>
<td>500</td>
<td>75</td>
<td>13.8</td>
</tr>
<tr>
<td>1205</td>
<td>250</td>
<td>100</td>
<td>22.6</td>
</tr>
<tr>
<td>1505</td>
<td>330</td>
<td>125</td>
<td>35.7</td>
</tr>
<tr>
<td>2005</td>
<td>1000</td>
<td>150</td>
<td>22.4</td>
</tr>
<tr>
<td>2208</td>
<td>750</td>
<td>175</td>
<td>21.3</td>
</tr>
<tr>
<td>2512</td>
<td>1500</td>
<td>200</td>
<td>13.6</td>
</tr>
</tbody>
</table>

*Case size indicates nominal part size. Example: 0705 is 75 x 50 mils.
Surface Mount Precision Thin Film

Precision thin film chip resistors are available in a range of resistance values with tolerances to 0.1% and temperature coefficient of resistance (TCR) to 25 ppm/°C.

Precision thin film resistors are available with resistance values from 5 Ω to 1 MΩ. The maximum resistance value decreases with decreasing case size. Thin film resistors have lower current capacity than semi-precision thick film resistors. Precision thin film resistors have low noise regardless of resistance value.

Wraparound terminations (C type) with the B finish (SN60 solder over nickel barrier) are used for surface mount applications using tin-lead based solders. The Y finish (silver over nickel barrier) is offered for use with RoHS solder alloys.

Other termination types and finishes are offered for other applications. Wire bond applications use A, D, or E termination types with a gold (W) finish. Epoxy bondable applications use C terminations type with gold (W) finish for use with conductive epoxies.

### Thin Film Chip Resistors

#### Cases and Ratings

<table>
<thead>
<tr>
<th>Case Size Code*</th>
<th>Rated Power (mW)</th>
<th>Rated Voltage (V)</th>
<th>Thermal Resistance (°C/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0202</td>
<td>25</td>
<td>20</td>
<td>32.2</td>
</tr>
<tr>
<td>0302</td>
<td>40</td>
<td>15</td>
<td>38.1</td>
</tr>
<tr>
<td>0303</td>
<td>50</td>
<td>30</td>
<td>22.3</td>
</tr>
<tr>
<td>0402</td>
<td>50</td>
<td>40</td>
<td>37.3</td>
</tr>
<tr>
<td>0502</td>
<td>60</td>
<td>40</td>
<td>29.3</td>
</tr>
<tr>
<td>0505</td>
<td>125</td>
<td>40</td>
<td>18.9</td>
</tr>
<tr>
<td>0603</td>
<td>100</td>
<td>45</td>
<td>25.7</td>
</tr>
<tr>
<td>0705</td>
<td>200</td>
<td>50</td>
<td>21.4</td>
</tr>
<tr>
<td>1005</td>
<td>250</td>
<td>75</td>
<td>24.9</td>
</tr>
<tr>
<td>1010</td>
<td>50</td>
<td>75</td>
<td>12.1</td>
</tr>
<tr>
<td>1206</td>
<td>250</td>
<td>100</td>
<td>21.0</td>
</tr>
<tr>
<td>1505</td>
<td>330</td>
<td>125</td>
<td>30.4</td>
</tr>
<tr>
<td>2010</td>
<td>1000</td>
<td>150</td>
<td>13.1</td>
</tr>
<tr>
<td>2208</td>
<td>750</td>
<td>175</td>
<td>18.8</td>
</tr>
<tr>
<td>2512</td>
<td>1500</td>
<td>200</td>
<td>12.7</td>
</tr>
</tbody>
</table>

* Case size indicates nominal part size. Example: 1206 is 120 x 60 mils.

**Termination Finish**
- B: SN60 solder over nickel barrier
- Y: Silver over nickel barrier
- K: SN60 solder bump
- M: Au/Sn solder bump
- W: Gold
- A: Aluminum

**Temperature Characteristic**
- E: ±25 ppm
- H: ±50 ppm
- K: ±100 ppm

**Tolerance**
- B: 0.1%
- C: 0.25%
- D: 0.5%
- F: 1%
- G: 2%
- J: 5%

**Resistance Value**
Three or four digits are used, with all leading digits significant. Four digits are used for 1% tolerance or lower; otherwise, three digits are used. The last digit specifies the number of zeros to add. The letter R is used to represent the decimal for fractional ohmic values. Example: 5R6 is 5.6 Ω; 10R0 is 10 Ω.

**Product Designation**
- A: Thin film on alumina
- F: High frequency on alumina
- N: High power on aluminum nitride
- S: Thin film on silicon

**Termination Type**
- A: Top-side termination/bottom isolated
- C: Wraparound termination
- F: Back Contact
- H: Wraparound/isolated center pad
- L: High frequency termination
- D: Top-side termination/bottom metallized
- E: Single wraparound/bottom metallized
- G: Wraparound/large bottoms
- M: Wraparound/one large bottom

**Size Code**
See Cases and Ratings Table

**Grade**
- S: Standard Production
- H: High Reliability

---

800-458-3401  www.resistor.com
### Silicon Chip Resistors

#### Cases and Ratings

<table>
<thead>
<tr>
<th>Case Code</th>
<th>Rated Power (mW)</th>
<th>Rated Voltage (V)</th>
<th>Thermal Resistance (˚C/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0202</td>
<td>100</td>
<td>100</td>
<td>15.6</td>
</tr>
<tr>
<td>0303</td>
<td>250</td>
<td>100</td>
<td>9.5</td>
</tr>
<tr>
<td>0404</td>
<td>350</td>
<td>100</td>
<td>5.4</td>
</tr>
<tr>
<td>0505</td>
<td>500</td>
<td>100</td>
<td>2.9</td>
</tr>
</tbody>
</table>

*Case size indicates nominal part size. Example: 0202 is 20 x 20 mils.

---

#### Wire Bondable Precision Thin Film on Silicon

The high thermal conductivity of the silicon substrate provides for higher power ratings and lower thermal resistance values than comparable resistors built on alumina.

These wire bondable resistors are built on silicon substrates with a 10000Å thick insulating layer of silicon dioxide which provides a breakdown voltage of 400 V minimum and insulation resistance of 10^12 Ω minimum. Silicon resistors are available in termination types A (top surface planar), D (top surface planar with metal back), and F (back contact) with gold or aluminum finish. Configuration varies with resistance value.

---

#### Back-Contact Resistors

Utilize the conductive silicon substrate as connection from the resistor to the back-contact on the chip. This back-contact eliminates one wire bond connection. These back-contact resistors are available in the 0202 case with resistance values >100Ω. Example: S0202FS1001DKW (see page 9)

#### Center-Tap Resistors

Have resistor elements of similar value connected in series. Center-tap resistor part numbers include –CT at the end of the precision thin film part number (see page 9) and may include a match tolerance code (-CTB) for the two resistors. The total resistance value is coded in the part number. Examples: S0303AS1001FEW-CT, S0303AS1001FEW-CTF (see page 9)

#### Dual-Tap Resistors

Have resistor elements of dissimilar value connected in series. Dual-tap resistor part numbers include –DT at the end of the precision thin film part number (see page 9) and may include a match tolerance code (-DTB) for the two resistors. The resistance value of R1 (indicated by the rounded contact) is coded within the part number. The resistance value of R2 is coded at the end of the part number. Examples: S0303AS1001FEW-DT2001, S0303AS1001FEW-DTB2001 (see page 9)

#### Dual Resistors

Provide two electrically isolated resistor elements of similar or dissimilar values. Dual resistor part numbers include –DR at the end of the precision thin film part number (see page 9) and may include a match tolerance code (-DRB) for the two resistors. The resistance value of R1 (indicated by the rounded contact) is coded within the part number. The resistance value of R2 is coded at the end of the part number when R1 and R2 have dissimilar values. Examples: S0303AS1001FEW-DR, S0303AS1001FEW-DRB2001 (see page 9)

#### Multi-Tap Resistors

Are comprised of 12 (MT1) or 20 (MT20) resistor elements connected in series through taps. MT1 devices are comprised of seven R1 and five R2 resistor elements where the resistance value of R1 is five times the value of R2. MT2 devices are comprised of ten R1 and ten R2 resistor elements where the resistance value of R1 is ten times the value of R2. The total resistance value is coded in the part number. Tolerances of five and ten percent are available. Multi-tap chip resistor part numbers include –MT1 or –MT2 at the end of the precision thin film part number. Example: S0303AS1103JKW-MT2 (see page 9)
Wire and Epoxy Bondable Precision Thin Film and Semi-Precision Thick Film on Ceramic

State of the Art, Inc. offers a variety of chip resistor and attenuator products for wire bond or epoxy bond applications.

MIL-PRF-55342 and MIL-PRF-32159 provides QPL chip resistors for hybrid applications. Termination material W provides devices for wire bonding, while the C, U, and G materials provide devices for conductive epoxy attachment. Examples: Wire bond: M55342K02W10D0S, Conductive epoxy bond: silver M55342K02C10D0S, gold M55342K02G10D0S, platinum-gold M55342K02U10D0S (see pages 3 and 4)

Standard and high reliability grade devices built on alumina ceramic substrates are also available for wire bond and epoxy bond applications in hybrids. High power wire bondable devices are also available that are built on beryllia (semi-precision thick film) and aluminum nitride (precision thin film) ceramic substrates.

Wire bondable devices have A, D, or E termination types with gold finish and are available in both precision thin film and semi-precision thick film products. Examples: Semi-precision thick film: S0402APG10R0F10, Precision thin film: S0505AA1001BEW (see pages 8 and 9)

Conductive epoxy devices have C termination type with gold, silver, or platinum gold finish. The gold finish is available in both precision and semi-precision products, while the silver and platinum gold finishes are only available as semi-precision thick film products. Examples: Semi-precision thick film: S0402CPG10R0F10, Precision thin film: S0402CA1001BEW (see pages 8 and 9)

Most of our special application resistors (current sense, high power, high voltage, etc.) are available in configurations suitable for wire bond or conductive epoxy applications. (see pages 14 and 15)

Our products for high frequency applications are also available for use in hybrids. We offer wire bondable fixed and temperature variable attenuators as well as wire bondable high frequency resistors and terminations. (see pages 12 and 13)
High Frequency Resistors

**Chip Resistors**

High frequency chip resistors are available in a wide range of resistance values and are designed to minimize loss at higher frequencies.

High frequency resistors made using thin film materials have lower loss at high frequency than resistors made using thick film materials. High frequency resistors with values from 5 to 200 ohms can be made using thin film materials. Thick film materials are used to produce high frequency resistors with resistance values from mΩ to MΩ.

**Surface Mount Chip Resistors**

Wraparound termination type C is used at frequencies <4 GHz. At frequencies >4GHz, inductive losses associated with the wraparound degrades performance. Flip chip mounting (film side down) reduces the inductive losses while providing a solder fillet that is readily inspected. Examples: **Precision thin film:** S0402CF500GKB, **Semi-precision thick film:** S0402CFX1R0G10 (see pages 8 and 9)

The planar terminations of the A termination type minimize inductive losses at higher frequencies when the device is flip chip soldered (film side down). Examples: **Precision thin film:** S0402AF500GKB, **Semi-precision thick film:** S0402AFX103G10 (see pages 8 and 9)

**Termination Resistors**

Termination resistors are available on alumina, beryllia (semi-precision high power), and aluminum nitride (precision high power) substrates using either the E or L termination type in solderable or wire bondable termination finishes.

Our E termination type devices perform well up to 5 GHz and are available in many cases. Examples: **Semi-precision high power:** S1206EBX500G20, **Precision high power:** S2525EN500GNB (see pages 8 and 9)

Our L termination type devices perform well up to 40 GHz and are available on aluminum nitride: Examples: S0505LL500GNW, S2525LL500GNB (see pages 8 and 9)

**Chip Resistors for Hybrids**

High frequency chip resistors, and termination resistors are available as wire bondable devices for use in hybrid packages.

Resistors: Examples: **Semi-precision thick film:** S0505AFG1001F20, **Precision thin film:** S0402AF50R0FEW (see pages 8 and 9)

Termination Resistors (<5 GHz): Examples: **Semi-precision high power:** S1206EBG502G20, **Precision high power:** S2525EN500GNW (see pages 8 and 9)

Termination Resistors (>5GHz): Examples: S0505LL500GNW, S2525LL500GNW (see pages 8 and 9)
Chip Attenuators

Chip attenuators are available in various termination types and finishes for applications at frequencies up to 40 GHz and beyond. We offer both fixed attenuators and temperature variable attenuators.

**Fixed Chip Attenuators**

Wraparound termination type C is used at frequencies <4 GHz. At frequencies >4 GHz, inductive losses associated with the wraparound degrade performance. Flip chip mounting (film side down) reduces the inductive losses while providing a solder fillet that is readily inspected. *Example: S1512CW3B0B*

The planar terminations of the A termination type minimize inductive losses at higher frequencies (>4 GHz) when the device is flip chip soldered (film side down). *Example: S0706AC10B0B*

**Fixed Chip Attenuators for Hybrids**

Chip attenuators for hybrids have a gold finish for wire bonding and either A or E termination type. *Examples: S0706AC1B0W, S1512EC10B0W*

**Coplanar Fixed Chip Attenuators**

Coplanar fixed chip attenuators are offered for both surface mount and hybrid applications. *Examples: Surface mount: S0303AC3B0B, Wire bondable: S0303AC3B0W*

**Temperature Variable Attenuators**

Temperature Variable Attenuators (TVA) passively compensate the output of temperature sensitive components (amplifiers, mixers, directional couplers, etc.) without distorting signal. Attenuation factor decreases with increasing ambient temperature but the attenuation factor changes at different rates above and below room temperature (see Attenuation vs. Temperature plot). An output tuned for temperatures above room temperature will perform poorly at temperatures below room temperature. Our Enhanced Temperature Variable Attenuators (ETVA) provide a linear response over the entire -55°C to 125°C temperature range allowing designers to use a single compensation solution without compromising performance. *Examples: TVA: S0706AT3B0BN7, ETVA: S0706AT3B0BE5*

### Fixed Attenuators

<table>
<thead>
<tr>
<th>Case Size Code</th>
<th>Rated Power (mW)</th>
<th>Frequency Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0303</td>
<td>50</td>
<td>DC - 40 GHz</td>
</tr>
<tr>
<td>0706</td>
<td>125</td>
<td>DC - 20 GHz</td>
</tr>
<tr>
<td>1005</td>
<td>250</td>
<td>DC - 18 GHz</td>
</tr>
<tr>
<td>1512</td>
<td>500</td>
<td>DC - 10 GHz</td>
</tr>
</tbody>
</table>

### Temperature Variable Attenuators

<table>
<thead>
<tr>
<th>Case Size Code</th>
<th>Rated Power (mW)</th>
<th>Frequency Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>0706</td>
<td>125</td>
<td>DC - 18 GHz</td>
</tr>
<tr>
<td>1512</td>
<td>500</td>
<td>DC - 6 GHz</td>
</tr>
</tbody>
</table>

**Termination Finish**

- B: SN60 solder over nickel barrier
- W: Gold

**Attenuation Factor**

Three or four characters indicating the attenuation factors with the B indicating the decimal

**Product Designation**

C: Thin film fixed on alumina
W: Thick film fixed on alumina
T: Thick film temperature variable on alumina

**Termination Type**

A: planar top side
C: wraparound
E: ground wraparound to metal back

**Case Size**

- S: Standard Grade
- H: High Reliability Grade

**Applicable for Product Designation T only**

Temperature Coefficient of Attenuation Slope

- N3: -0.003 dB/dB/°C
- N7: -0.007 dB/dB/°C
- N9: -0.009 dB/dB/°C
- E5: enhanced slope -0.005 dB/dB/°C

**Grade**

- S: Standard Grade
- H: High Reliability Grade

---

800-458-3401   www.resistor.com
High Power

High power resistors are built on high thermal conductivity substrates. Semi-precision thick film devices are constructed on beryllia, while our precision thin film devices are built on aluminum nitride.

High power devices with termination types D and E have the lowest thermal resistance values (or highest power rating) for a case size. These termination types use the metal back as the primary thermal path to ground. The metal back is typically attached to a heat sink. Assembly is required to make the electrical connection to the device using ribbon leads or wire bonds. High power resistors (like all surface mount resistors) are conduction cooled — your thermal management scheme must spread the heat from the device to thermal ground. Termination finishes for soldering and wire bonding are available. Examples: Precision thin film: S2525EN50R0GKB, Semi-precision thick film: S0505DBG101G20 (see pages 8 and 9)

Surface Mount High Power

High power resistors are offered in several termination types and finishes suitable for surface mount applications. We offer SN60 solder over nickel barrier for applications using tin-lead solder. We also offer silver over nickel barrier for RoHS lead-free soldering.

<table>
<thead>
<tr>
<th>Case Size Code*</th>
<th>D, E (W)</th>
<th>C (W)</th>
<th>G, M (W)</th>
<th>H (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0505</td>
<td>10</td>
<td>1.0</td>
<td>1.5</td>
<td>1.0</td>
</tr>
<tr>
<td>0705</td>
<td>4</td>
<td>0.75</td>
<td></td>
<td>1.0</td>
</tr>
<tr>
<td>1010</td>
<td>14</td>
<td>1.25</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>1206</td>
<td>14</td>
<td>1.5</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>1512</td>
<td>20</td>
<td>2.0</td>
<td>3.0</td>
<td>4.0</td>
</tr>
<tr>
<td>2010</td>
<td>30</td>
<td>2.5</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>2335</td>
<td>125</td>
<td>5.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>2512</td>
<td>50</td>
<td>2.5</td>
<td>4.0</td>
<td>4.0</td>
</tr>
<tr>
<td>2525</td>
<td>100</td>
<td>4.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
<tr>
<td>3825</td>
<td>150</td>
<td>4.0</td>
<td>15.0</td>
<td>15.0</td>
</tr>
<tr>
<td>3838</td>
<td>200</td>
<td>5.0</td>
<td>20.0</td>
<td>20.0</td>
</tr>
</tbody>
</table>

* Case size indicates nominal part size. Example: 3838 is 375 x 375 mils.

- Termination type C employs bottom end bands typically found on surface mount resistors. The heat produced by the resistor element is conducted through the device to the solder fillets and spread by the traces on the board that carry the electrical signal.

- Termination type G uses two large bottom end bands of equal length to shorten the thermal path through the device to the traces on the board that carry the electrical signal.

- Termination type M uses one very large bottom end band to shorten the thermal path to one of the traces on board.

- Termination type H uses the end band configuration found on the C type and adds an electrically isolated central pad that is used to remove the heat. A trace can connect the central thermal management pad to a thermal via or ground plane to spread the heat away from the resistor.
Current Sense

Four terminal current sense resistors provide separate current source and sense inputs for precise current sense applications. Current sense resistors are available in resistance values from $0.020 \Omega$ to $5 \Omega$ in surface mount and wire bondable types. Current sense resistors are specified using product code K. Example: S2010CKX0R05J (see page 8)

High Voltage

High voltage chip resistors are available in resistance values from $5 \text{k} \Omega$ to $1 \text{G} \Omega$ with ratings from $600 \text{V}$ to $5 \text{kV}$. High voltage resistors are available in surface mount and wire bondable types. High voltage resistors are specified using product code V. Examples: S2010CVX1003F10, S2010AVG1004F10 (see page 8)

Zero Ohm Jumpers

Zero ohm jumpers (chip resistors) are available in all the cases cited on p. 8. These jumpers are made using thick film materials and use 000 as the value code in the thick film part number scheme found on p. 8. Termination finishes are available for solderable applications (X & Y) as well as for hybrid applications (G, P, & C). Examples: S0705CPX000, S0505APG000 (see page 8)

Untrimmed Resistors

Untrimmed thick film resistors can be mounted into a circuit and subsequently dynamically laser trimmed to tune circuit performance. Untrimmed resistors also perform better than trimmed resistors in pulse power applications due to reduced current crowding around the trim. Untrimmed resistors are available in 10 and 20% tolerances. Untrimmed resistors are specified using the U product code in the thick film part number. Example: S1206CUX101M20 (see page 8)

Current Sense Chip Resistors

<table>
<thead>
<tr>
<th>Case Size Code*</th>
<th>Rated Power (mW)</th>
<th>Rated Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1005</td>
<td>125</td>
<td>75</td>
</tr>
<tr>
<td>1206</td>
<td>150</td>
<td>100</td>
</tr>
<tr>
<td>2010</td>
<td>650</td>
<td>150</td>
</tr>
<tr>
<td>2512</td>
<td>1000</td>
<td>200</td>
</tr>
</tbody>
</table>

* Case size indicates nominal part size. Example: 2512 is 250 x 125 mils.

High Voltage Chip Resistors

<table>
<thead>
<tr>
<th>Case Size Code*</th>
<th>Rated Power (mW)</th>
<th>Rated Voltage (V)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1000</td>
<td>600</td>
</tr>
<tr>
<td>2512</td>
<td>1500</td>
<td>1200</td>
</tr>
<tr>
<td>3818</td>
<td>2000</td>
<td>2500</td>
</tr>
<tr>
<td>3838</td>
<td>3000</td>
<td>5000</td>
</tr>
</tbody>
</table>

* Case size indicates nominal part size. Example: 2010 is 200 x 100 mils.
Resistor Networks

JEDEC and SLAMDIP surface mount resistor networks provide semi-precision performance in a high density package.

The resistors comprising the network typically have a single resistance value ranging from 5 to 10 MΩ but we have produced custom designs with differing resistance values.

Available tolerances include 1, 2, 5, and 10%.

Available temperature characteristics of resistance values include ±100, 200, and 300 ppm/°C.

The SN60 solder over nickel barrier termination finish is used for surface mount applications using tin-lead solder.
Power Rating
Power ratings for MIL-PRF-55342 products are assigned by the specification. Our power ratings have been set to ensure the devices will operate reliably at full power in a 70°C ambient temperature. Both military and standard grade resistors are linearly derated from full rated power at 70°C ambient to zero power at 150°C ambient to limit the film temperature to 150°C maximum.

Power Handling Capability
State of the Art, Inc. resistor products are conduction-cooled devices. Maintaining the film temperature at ≤150°C is the most important factor in reliable operation of these resistor products. The maximum power handling capability is determined by the ability of the chip and the mounting method to remove the heat generated by the resistor. SOTA lists thermal resistance values so our customers can determine how much power can be dissipated in their application.

Voltage Rating
The rated voltage of a chip resistor is determined by the continuous voltage stress the device can accommodate. Operation in excess of the rated voltage may compromise stability. Short time overloads (less than 5 seconds) up to twice the rated voltage will not degrade the chip significantly.

Life Test Performance
State of the Art, Inc. (SOTA) maintains the established reliability rating of our MIL-PRF-55342 resistors at level S (0.001%/1,000 hours). SOTA performs >120 million unit hours of life testing in order to maintain these failure rates. A life test failure is defined as a change in resistance value larger than ±2.0% for failure rate maintenance and ±0.5% for qualification. These life tests are performed at 70°C ambient at maximum operating voltage applied for 90 minutes on, 30 minutes off, for 10,000 hours.

Test Criteria
Pass/fail criteria for our standard and high reliability thick and thin resistors as well as our MIL-PRF-55342 qualified chip resistors are listed in the table below. The criteria for the MIL-PRF-55342 product are based upon the resistance temperature characteristic. Temperature characteristics K and M are typically produced using thick film technology, while temperature characteristics E and H can only be produced using thin film technology. The pass/fail criteria for our standard grade thick and thin film products mimic those stated in MIL-PRF-55342.
Resistor Performance

**Temperature Coefficient of Resistance (TCR)**
TCR is a measure of the stability of the resistance value with respect to changes in temperature. Standard TCR values for our thick film resistors are ± 100, 200, and 300 ppm/°C. Standard thin film TCR values are ±25, 50, and 100 ppm/°C.

**TCR Tracking**
Resistors of similar value from the same manufacturing lot show little variation in TCR behavior from chip to chip. TCR values within a typical thick film lot vary less than 50 ppm, while TCR values within a typical thin film manufacturing lot vary less than 30 ppm. Tracking less than 15 ppm can be achieved in a thin film lot when required. Resistors from different manufacturing lots can have a much wider variation in TCR. If close tracking is required, please specify when ordering so that we can supply you with selected resistors from a single manufacturing lot.

**Voltage Coefficient of Resistance (VCR)**
VCR is a measure of the stability of the resistor with respect to changes in voltage. Thick film resistors can exhibit significant VCR values. Low value chips may have a VCR of less than 10 ppm/V, while high value chips may change by 200 or 300 ppm/V or more. Thin film resistors have low VCR values regardless of size and resistance value, with a typical change in resistance of less than 2 ppm/V. Where VCR is critical, thin film resistors or high voltage products can provide the desired performance.

**Pulse Handling Capability**
State of the Art, Inc. resistor products are capable of withstanding short duration pulses that exceed the device’s power or voltage ratings. Pulses less than the short time overload test conditions (2.5 times the working voltage, not to exceed two times the rated voltage for 5 seconds) are easily accommodated by the devices. Pulses exceeding the short time overload test conditions must be assessed on a case-by-case basis. Please consult our factory for an assessment of your application.

**Frequency Response**
The frequency response of a chip resistor is primarily determined by its inductive and capacitive properties and is nearly ideal into the GHz region. The interelectrode capacitance of our resistors is typically 0.05 to 0.12 picofarads. The actual value is determined by the size of the chip (smaller case sizes have lower capacitance) and the termination style (planar, style A, devices have lower capacitance than wraparound, style C, devices). Inductance is typically less than 0.5 nanohenries, with the same design influences as listed for the capacitance values of the chips.

**Noise**
Current noise is expressed as the ratio of the rms value of the current noise voltage to the applied voltage. The magnitude of this noise is dependent on the resistive material, chip length, and termination materials. Noise increases with resistance value and shorter case length in thick film resistors. Thin film resistors exhibit low noise levels in all case sizes and resistance values.

**Operating Range**
State of the Art, Inc. resistor products have a wide operating range, from cryogenic temperatures to 150°C. Permanent drift occurs when the resistors are operated above 150°C due to degradation to the terminations and the resistor film.
**Storage Conditions**
Chip resistors should be stored at 23±5°C and 10-70% relative humidity and avoid oxidizing conditions which adversely affect the termination finish. Exposure to excessive humidity, direct sunlight, and contact with sulfur-containing materials (rubber bands, etc.) should be avoided. Storage under an inert atmosphere should be considered if these devices are to be stored for extended time periods.

Product supplied on tape and reel packaging can be stored for up to two years at 23±5°C and 10-70% relative humidity with no degradation in the quality of the tape and reel packaging.

**Electrostatic Discharge (ESD) Susceptibility**
Thick and thin film chip resistors are classified as ESD sensitive devices by MIL-HDBK-263. ESD precautions should be taken when handling these devices. Tested in accordance with MIL-STD-883, Method 3015, thick and thin film resistors are Class 1 (<2000 V), Class 2 (<4000 V), or Class 3 (>4000 V) per MIL-STD-1686. ESD sensitivity depends on the manufacturing technology, the case length, and the resistance value.

**Thick Film Resistors:** Resistors with a case length less than 0.055” are Class 1. Resistors with a case length between 0.055” and 0.135” are Class 2. Resistors with a case length greater than 0.135” are Class 3.

**Thin Film Resistors:** Resistors with a case length of less than 0.090” are Class 2. Resistors with a length greater than 0.090” are Class 3.

**Radiation Hardness**
Neither thick nor thin film resistors are affected by radiation. They are classified as radiation hard devices.

**Outgassing**
Space and other vacuum applications require that all organic materials be non-outgassing. Inorganic materials, such as ceramics and metals, are not subject to outgassing. All organic materials used in State of the Art, Inc. products comply with the outgassing requirements of Space Level MIL-PRF-55342 when tested in accordance with ASTM E595.

**Moisture Sensitivity Level (MSL)**
All of our surface mount products are classified as MSL 1 per JSTD-020D.1.
### Part Marking

Resistance value may be coded on some devices. Three digit codes can be marked on 0603 and larger case sizes. Those values that require four digit codes can be marked on 1005 and larger cases. Two marking schemes are available.

The first option uses a three digit code for 2% and higher tolerances and four digit code for 1% and lower tolerances, where the leading digits are the significant digits of the value and the last digit is the multiplier, indicating the number of zeros to add. The letter R is used as the decimal. For example, 100Ω±2% is coded 102 while 1000Ω±1% is coded 1001. This significant digit and multiplier method is most commonly used to mark resistance value.

The second option uses the EIA-96 marking scheme and allows the coding of 1% values using three digits and a look up table. The first two digits code the three significant digits of the resistance value, while the third character is a letter designating the multiplier. For example, 49.9 kΩ±1% is coded 68C. This method can also be used to mark 1% standard values at tolerances less than 1%.

Custom markings are also available. Please consult the factory with your requirements.

The marking code is specified by adding a blank space followed by –CC to our part number to code 1000 ohms. Example: S0705CPF1001F0 – CC01B codes 1000 ohms using the EIA-96 method.

### Standard Resistance Values

This table shows the standard resistance values for various resistance tolerances per decade. MIL-PRF-55342 only allows standard 1%, 2%, 5%, and 10% values to be JAN branded. Non-standard values can be supplied without the JAN brand. Although it is not cited in the table, 50 is considered a standard value for all product except MIL-PRF-55342.
Labeling

Our packages are labeled using a non-corrosive label citing your part number, our part number, date code, lot, quantity, and value and tolerance.

Packaging

Product may be shipped in re-sealable bags, waffle trays, or carrier tape.

Bulk packaging in re-sealable, anti-static bags is limited to standard grade chips. Bulk packaging is the default packaging for standard grade chips if a packaging method is not specified. Packaging of one device per bag is available for high reliability chips.

Military and high reliability chips are shipped in waffle trays or carrier tape. Waffle tray packaging of surface mount chips is more cost effective at lower quantities but becomes more costly than carrier tape packaging at higher quantities. Most wire bondable chips are supplied in waffle trays, including all silicon chip resistors.

Waffle tray packaging may be indicated by adding a space and -W to the end of our part number. Example: H1206CA1001FHB -W

Carrier tape packaging (tape and reel) may be indicated by adding a space and -TR to the end of our part number. Example: H1206CA1001FHB -TR
State of the Art, Inc.
MISSION-CRITICAL RESISTOR SPECIALISTS.

2470 Fox Hill Road, State College, PA 16803
Phone: 814-355-8004 • Fax: 814-355-2714 • Source Code: 56235
Toll Free: 1-800-458-3401 • www.resistor.com