

# SEMTECH INDUSTRIAL HIGH VOLTAGE CAPACITORS MONOLITHIC CERAMIC TYPE

Semtech's Industrial Capacitors employ a new body design for cost efficient, volume manufacturing. This capacitor body design also expands our voltage capability to 10 KV and our capacitance range to .47 $\mu$ F. If your requirement exceeds our single device ratings, Semtech can build a custom capacitor assembly to reach the values you need.

- X7R AND NPO DIELECTRICS • 100 pF TO .47 $\mu$ F CAPACITANCE RANGE • 1 TO 10 KV VOLTAGE RANGE
- 14 CHIP SIZES

## CAPABILITY MATRIX

| Size | Bias Voltage (Note 2) | Dielectric Type | Maximum Capacitance—EIA Code (Note 1) |      |      |      |      |      |      |      |      |       |  |
|------|-----------------------|-----------------|---------------------------------------|------|------|------|------|------|------|------|------|-------|--|
|      |                       |                 | 1 KV                                  | 2 KV | 3 KV | 4 KV | 5 KV | 6 KV | 7 KV | 8 KV | 9 KV | 10 KV |  |
| 1515 | —<br>VDCW<br>0        | NPO             | 102                                   | 561  | 271  | 181  | 121  |      |      |      |      |       |  |
|      |                       | X7R             | 562                                   | 222  | 102  | 471  | 271  |      |      |      |      |       |  |
|      |                       | X7R             | 123                                   | 472  | 222  | 821  | 561  |      |      |      |      |       |  |
| 2020 | —<br>VDCW<br>0        | NPO             | 182                                   | 122  | 561  | 331  | 221  | 181  |      |      |      |       |  |
|      |                       | X7R             | 103                                   | 472  | 182  | 681  | 471  | 271  |      |      |      |       |  |
|      |                       | X7R             | 223                                   | 103  | 392  | 152  | 102  | 561  |      |      |      |       |  |
| 2520 | —<br>VDCW<br>0        | NPO             | 222                                   | 152  | 681  | 391  | 271  | 221  | 101  |      |      |       |  |
|      |                       | X7R             | 153                                   | 682  | 222  | 821  | 561  | 331  | 181  |      |      |       |  |
|      |                       | X7R             | 333                                   | 123  | 472  | 182  | 122  | 681  | 391  |      |      |       |  |
| 3333 | —<br>VDCW<br>0        | NPO             | 682                                   | 472  | 222  | 122  | 821  | 561  | 271  |      |      |       |  |
|      |                       | X7R             | 473                                   | 153  | 562  | 272  | 182  | 102  | 561  |      |      |       |  |
|      |                       | X7R             | 104                                   | 333  | 123  | 562  | 392  | 222  | 122  |      |      |       |  |
| 3530 | —<br>VDCW<br>0        | NPO             | 562                                   | 392  | 182  | 102  | 681  | 471  | 221  |      |      |       |  |
|      |                       | X7R             | 393                                   | 153  | 562  | 272  | 182  | 102  | 561  |      |      |       |  |
|      |                       | X7R             | 823                                   | 333  | 123  | 562  | 392  | 222  | 122  |      |      |       |  |
| 4020 | —<br>VDCW<br>0        | NPO             | 152                                   | 102  | 821  | 681  | 391  | 331  | 271  | 181  | 121  | 101   |  |
|      |                       | X7R             | 123                                   | 562  | 272  | 122  | 821  | 681  | 471  | 391  | 391  | 331   |  |
|      |                       | X7R             | 223                                   | 123  | 562  | 272  | 182  | 152  | 102  | 821  | 681  | 561   |  |
| 4040 | —<br>VDCW<br>0        | NPO             | 103                                   | 682  | 332  | 222  | 122  | 102  | 391  | 331  |      |       |  |
|      |                       | X7R             | 563                                   | 273  | 103  | 392  | 272  | 182  | 471  | 471  |      |       |  |
|      |                       | X7R             | 124                                   | 563  | 223  | 822  | 562  | 392  | 182  | 102  |      |       |  |
| 4540 | —<br>VDCW<br>0        | NPO             | 123                                   | 822  | 332  | 222  | 152  | 122  | 471  | 331  |      |       |  |
|      |                       | X7R             | 683                                   | 333  | 123  | 472  | 332  | 222  | 102  | 561  |      |       |  |
|      |                       | X7R             | 154                                   | 683  | 273  | 103  | 682  | 472  | 222  | 122  |      |       |  |
| 5040 | —<br>VDCW<br>0        | NPO             | 182                                   | 122  | 102  | 681  | 471  | 391  | 271  | 221  | 151  | 121   |  |
|      |                       | X7R             | 153                                   | 682  | 332  | 152  | 102  | 821  | 561  | 471  | 391  | 391   |  |
|      |                       | X7R             | 273                                   | 153  | 682  | 332  | 222  | 182  | 122  | 102  | 821  | 681   |  |
| 5440 | —<br>VDCW<br>0        | NPO             | 153                                   | 103  | 472  | 272  | 182  | 122  | 561  | 391  |      |       |  |
|      |                       | X7R             | 104                                   | 333  | 153  | 562  | 392  | 272  | 122  | 681  |      |       |  |
|      |                       | X7R             | 224                                   | 683  | 333  | 123  | 822  | 562  | 272  | 152  |      |       |  |
| 5550 | —<br>VDCW<br>0        | NPO             | 183                                   | 123  | 562  | 332  | 222  | 152  | 681  | 561  |      |       |  |
|      |                       | X7R             | 124                                   | 393  | 183  | 682  | 472  | 332  | 152  | 821  |      |       |  |
|      |                       | X7R             | 274                                   | 823  | 393  | 153  | 103  | 682  | 332  | 182  |      |       |  |
| 6560 | —<br>VDCW<br>0        | NPO             | 273                                   | 183  | 822  | 562  | 332  | 272  | 122  | 821  |      |       |  |
|      |                       | X7R             | 184                                   | 563  | 273  | 103  | 682  | 472  | 272  | 122  |      |       |  |
|      |                       | X7R             | 394                                   | 124  | 563  | 223  | 153  | 103  | 562  | 272  |      |       |  |
| 6666 | —<br>VDCW<br>0        | NPO             | 123                                   | 682  | 562  | 472  | 272  | 222  | 152  | 122  | 102  | 681   |  |
|      |                       | X7R             | 823                                   | 473  | 183  | 822  | 682  | 472  | 332  | 272  | 182  | 122   |  |
|      |                       | X7R             | 154                                   | 104  | 393  | 183  | 153  | 103  | 682  | 562  | 392  | 272   |  |
| 7565 | —<br>VDCW<br>0        | NPO             | 333                                   | 223  | 103  | 682  | 392  | 332  | 152  | 102  |      |       |  |
|      |                       | X7R             | 224                                   | 683  | 333  | 123  | 822  | 562  | 332  | 152  |      |       |  |
|      |                       | X7R             | 474                                   | 154  | 683  | 273  | 183  | 123  | 682  | 332  |      |       |  |

- NOTES: 1. EIA Capacitance Code: Value in Picofarads, two significant figures followed by number of zeros: 562 = 5600 pF, 273 = 27000 pF (.027 mfd).
2. • Class I Dielectric (NPO) has zero voltage coefficient. Values shown are at 0 volt bias, or at working volts (VDCW).  
• Class II Dielectric (X7R) has voltage coefficient, and values derate at VDCW by up to 50% of value at 0 volt bias. Capacitance @ VDCW is function of design of unit and may vary.



## INDUSTRIAL CAPACITOR DC VOLTAGE COEFFICIENTS



## GENERAL SPECIFICATIONS

- **OPERATING TEMPERATURE RANGE**  
-55°C to 125°C
- **TEMPERATURE COEFFICIENT**  
NPO: ±30 ppm/°C  
X7R: ±15% ΔC Max.
- **DISSIPATION FACTOR**  
NPO: 0.1% Max, 0.02% typical  
X7R: 2.5% Max, 1.5% typical
- **INSULATION RESISTANCE**  
@ 25°C, 1.0 KV: >100GΩ or 10000ΩF, whichever is less  
@ 125°C, 1.0 KV: >10GΩ or 1000ΩF, whichever is less
- **DIELECTRIC WITHSTANDING VOLTAGE**  
1.2 × VDCW Min, 50 m-amp Max, 5 seconds
- **AGING RATE**  
NPO: 0% per decade hour  
X7R: <2.0% per decade hour
- **TEST PARAMETERS**  
1 KHz, 1.0 VRMS ±0.2 VRMS, 25°C  
0 Volts

# SEMTECH INDUSTRIAL HIGH VOLTAGE CAPACITORS MONOLITHIC CERAMIC TYPE (cont.)

## CHIP DIMENSIONS

| Size | (Nom.) Len.<br>In. (mm) | (Nom.) Wid.<br>In. (mm) | T (Max)<br>In. (mm) |
|------|-------------------------|-------------------------|---------------------|
| 1515 | .150±.015<br>(3.81±.38) | .150±.015<br>(3.81±.38) | .120<br>(3.05)      |
| 2020 | .200±.020<br>(5.08±.51) | .200±.020<br>(5.08±.51) | .120<br>(3.05)      |
| 2520 | .230±.023<br>(5.84±.58) | .190±.019<br>(4.82±.48) | .120<br>(3.05)      |
| 3333 | .330±.033<br>(8.38±.84) | .330±.033<br>(8.38±.84) | .150<br>(3.81)      |
| 3530 | .350±.035<br>(8.89±.89) | .300±.030<br>(7.62±.76) | .150<br>(3.81)      |
| 4020 | .400±.040<br>(10.2±1.0) | .200±.020<br>(5.08±.51) | .150<br>(3.81)      |
| 4040 | .400±.040<br>(10.2±1.0) | .400±.040<br>(10.2±1.0) | .150<br>(3.81)      |
| 4540 | .450±.045<br>(11.4±1.1) | .400±.040<br>(10.2±1.0) | .150<br>(3.81)      |
| 5040 | .460±.046<br>(11.7±1.2) | .380±.038<br>(9.65±.97) | .150<br>(3.81)      |
| 5440 | .540±.054<br>(13.7±1.4) | .400±.040<br>(10.2±1.0) | .150<br>(3.81)      |
| 5550 | .550±.055<br>(14.0±1.4) | .500±.050<br>(12.7±1.3) | .150<br>(3.81)      |
| 6560 | .650±.065<br>(16.5±1.7) | .600±.060<br>(15.2±1.5) | .175<br>(4.45)      |
| 6666 | .660±.066<br>(16.8±1.7) | .660±.066<br>(16.8±1.7) | .175<br>(4.45)      |
| 7565 | .750±.075<br>(19.0±1.9) | .650±.065<br>(16.5±1.7) | .175<br>(4.45)      |

## ENCAPSULATED DIMENSIONS

| Size | Len. (Max)<br>In. (mm) | Wid. (Max)<br>In. (mm) | T (Max)<br>In. (mm) | S<br>In. (mm)           |
|------|------------------------|------------------------|---------------------|-------------------------|
| 1515 | .300<br>(7.62)         | .300<br>(7.62)         | .220<br>(5.59)      | .180±.03<br>(4.57±.46)  |
| 2020 | .350<br>(8.89)         | .350<br>(8.89)         | .220<br>(5.59)      | .230±.03<br>(5.84±.58)  |
| 2520 | .380<br>(9.65)         | .340<br>(8.64)         | .220<br>(5.59)      | .260±.03<br>(6.60±.66)  |
| 3333 | .480<br>(12.2)         | .480<br>(12.2)         | .250<br>(6.35)      | .360±.033<br>(9.14±.91) |
| 3530 | .500<br>(12.7)         | .450<br>(11.4)         | .250<br>(6.35)      | .380±.035<br>(9.65±.97) |
| 4020 | .550<br>(13.97)        | .350<br>(8.89)         | .250<br>(6.35)      | .430±.040<br>(10.9±1.1) |
| 4040 | .550<br>(13.97)        | .550<br>(13.97)        | .250<br>(6.35)      | .430±.040<br>(10.9±1.1) |
| 4540 | .600<br>(15.24)        | .550<br>(13.97)        | .250<br>(6.35)      | .480±.045<br>(12.2±1.2) |
| 5040 | .610<br>(15.49)        | .530<br>(12.46)        | .250<br>(6.35)      | .490±.046<br>(12.4±1.2) |
| 5440 | .690<br>(17.53)        | .550<br>(13.97)        | .250<br>(6.35)      | .570±.054<br>(14.5±1.4) |
| 5550 | .700<br>(17.78)        | .650<br>(16.51)        | .250<br>(6.35)      | .580±.058<br>(14.7±1.5) |
| 6560 | .800<br>(20.32)        | .750<br>(19.05)        | .275<br>(6.99)      | .680±.065<br>(17.3±1.7) |
| 6666 | .810<br>(20.57)        | .810<br>(20.57)        | .275<br>(6.99)      | .690±.066<br>(17.5±1.8) |
| 7565 | .900<br>(22.86)        | .800<br>(20.32)        | .275<br>(6.99)      | .780±.075<br>(19.8±2)   |

## ORDERING INSTRUCTIONS

| 2020           | A             | X                   | 103                    | K                     | 2              |
|----------------|---------------|---------------------|------------------------|-----------------------|----------------|
| PART SIZE CODE | FORM          | DIELECTRIC MATERIAL | CAPACITANCE (EIA CODE) | CAPACITANCE TOLERANCE | VOLTAGE RATING |
| 1515           | CHIP          | X=X7R               | Last digit             | J=5%                  | 1 KV           |
| 2020           | A=Silver      |                     | indicates number       | K=10%                 | 2 KV           |
| "              | Termination   | N=NPO               | of zeroes              | M=20%                 | "              |
| "              | D=Palladium / |                     | following the first    | Z=+80%-20%            | "              |
| 7565           | Silver        |                     | two digits.            |                       | 10 KV          |
|                | Termination   |                     | Ex. 103=10000 pF       |                       |                |
|                | <b>LEADED</b> |                     |                        |                       |                |
|                | E=Epoxy       |                     |                        |                       |                |
|                | Encapsulated  |                     |                        |                       |                |
|                | L=Leaded Only |                     |                        |                       |                |