

## Surface Mount Multilayer Ceramic Chip Capacitor for High Voltage Applications



### FEATURES

- High voltage breakdown compared to standard design
- High reliability serial electrode design
- Polymer termination available for intensive, board flex requirements
- Protective surface coating may be required to prevent surface arcing
- Excellent reliability and thermal shock performance
- Wet build process
- Reliable Noble Metal Electrode (NME) system
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
**GREEN**  
(5-2008)

### LINKS TO ADDITIONAL RESOURCES


[Packages](#)

[Technical Notes](#)

[Related Documents](#)

### APPLICATIONS

- Input filter capacitors
- Output filter capacitors
- Snubber capacitors reduce MOSFET voltage spikes
- Filtering for switching power supplies
- For lighting and other AC applications please contact: [mlcc@vishay.com](mailto:mlcc@vishay.com)

### ELECTRICAL SPECIFICATIONS

| COG (NP0)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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| <b>GENERAL SPECIFICATION</b><br><b>Note</b><br>Electrical characteristics at +25 °C unless otherwise specified<br><br><b>Operating Temperature:</b> -55 °C to +125 °C<br><br><b>Capacitance Range:</b> 10 pF to 3.3 nF<br><br><b>Voltage Range:</b> 500 V <sub>DC</sub> to 5000 V <sub>DC</sub><br><br><b>Temperature Coefficient of Capacitance (TCC):</b><br>0 ppm/°C ± 30 ppm/°C from -55 °C to +125 °C<br><br><b>Dissipation Factor (DF):</b><br>0.1 % maximum at 1.0 V <sub>RMS</sub> and 1 MHz for value ≤ 1000 pF<br>0.1 % maximum at 1.0 V <sub>RMS</sub> and 1 kHz for values > 1000 pF<br><br><b>Insulating Resistance:</b><br>at +25 °C 100 000 MΩ min. or 1000 ΩF whichever is less<br>at +125 °C 10 000 MΩ min. or 100 ΩF whichever is less<br><br><b>Aging Rate:</b> 0 % maximum per decade<br><br><b>Dielectric Strength Test:</b><br>applied test voltages<br>120 % of rated voltage |

| X7R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>GENERAL SPECIFICATION</b><br><b>Note</b><br>Electrical characteristics at +25 °C unless otherwise specified<br><br><b>Operating Temperature:</b> -55 °C to +125 °C<br><br><b>Capacitance Range:</b> 47 pF to 560 nF<br><br><b>Voltage Range:</b> 500 V <sub>DC</sub> to 8000 V <sub>DC</sub><br><br><b>Temperature Coefficient of Capacitance (TCC):</b><br>± 15 % from -55 °C to +125 °C, with 0 V <sub>DC</sub> applied<br><br><b>Dissipation Factor (DF):</b><br>2.5 % maximum at 1.0 V <sub>RMS</sub> and 1 kHz<br><br><b>Insulating Resistance:</b><br>at +25 °C 100 000 MΩ min. or 1000 ΩF whichever is less<br>at +125 °C 10 000 MΩ min. or 100 ΩF whichever is less<br><br><b>Aging Rate:</b> 1 % maximum per decade<br><br><b>Dielectric Strength Test:</b><br>applied test voltages<br>min. 120 % of rated voltage |



## QUICK REFERENCE DATA

| DIELECTRIC | CASE | MAXIMUM VOLTAGE (V) | CAPACITANCE |         |
|------------|------|---------------------|-------------|---------|
|            |      |                     | MINIMUM     | MAXIMUM |
| C0G (NP0)  | 1206 | 1500                | 10 pF       | 120 pF  |
|            | 1210 | 2000                | 10 pF       | 120 pF  |
|            | 1808 | 3000                | 27 pF       | 220 pF  |
|            | 1812 | 5000                | 15 pF       | 1.8 nF  |
|            | 1825 | 5000                | 15 pF       | 2.2 nF  |
|            | 2220 | 5000                | 33 pF       | 2.2 nF  |
|            | 2225 | 5000                | 47 pF       | 3.3 nF  |
| X7R        | 1206 | 2000                | 270 pF      | 4.7 nF  |
|            | 1210 | 2000                | 390 pF      | 10 nF   |
|            | 1808 | 6000                | 47 pF       | 18 nF   |
|            | 1812 | 6000                | 150 pF      | 27 nF   |
|            | 1825 | 4000                | 330 pF      | 56 nF   |
|            | 2220 | 6000                | 330 pF      | 82 nF   |
|            | 2225 | 6000                | 470 pF      | 100 nF  |
|            | 3040 | 1500                | 33 nF       | 220 nF  |
|            | 3640 | 8000                | 470 pF      | 390 nF  |
|            | 4044 | 1500                | 100 nF      | 560 nF  |

## Notes

- Detail ratings see "Selection Chart"
- For special high voltage applications including Open Mode Design and ArcGuard please consult series datasheet
- High voltage capacitors may require a conformal coating to deter arc-over during operation

## ORDERING INFORMATION

| HV2220                                                                       | Y                        | 152                                                                                                                                | K                                                                                                                                                | X                                                                                                              | M                                                                                                                                      | A                                                                                       | T         | HV <sup>(3)</sup> |
|------------------------------------------------------------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|-----------|-------------------|
| CASE CODE                                                                    | DIELECTRIC               | CAPACITANCE NOMINAL CODE                                                                                                           | CAPACITANCE TOLERANCE                                                                                                                            | TERMINATION                                                                                                    | DC VOLTAGE RATING <sup>(2)</sup>                                                                                                       | MARKING                                                                                 | PACKAGING | PROCESS CODE      |
| 1206<br>1210<br>1808<br>1812<br>1825<br>2220<br>2225<br>3040<br>3640<br>4044 | Y = X7R<br>A = C0G (NP0) | Expressed in picofarads (pF). The first two digits are significant, the third is a multiplier.<br><b>Examples</b><br>152 = 1500 pF | C0G (NP0):<br>F = $\pm 1\%$<br>G = $\pm 2\%$<br>J = $\pm 5\%$<br>K = $\pm 10\%$<br><br>X7R:<br>J = $\pm 5\%$<br>K = $\pm 10\%$<br>M = $\pm 20\%$ | X = Ni barrier<br>100 % tin plated matte finish<br>B = polymer <sup>(1)</sup><br>100 % tin plated matte finish | E = 500 V<br>L = 630 V<br>G = 1000 V<br>R = 1500 V<br>F = 2000 V<br>H = 3000 V<br>V = 4000 V<br>M = 5000 V<br>6 = 6000 V<br>8 = 8000 V | A = unmarked<br><br>T = 7" reel / plastic tape<br>R = 11 1/4" / 13" reel / plastic tape |           | HV = high voltage |

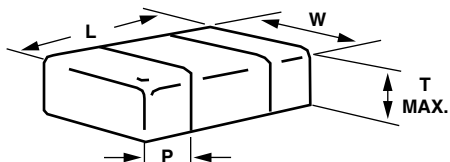
## Notes

- (1) Polymer termination code B is available for case sizes 1206 thru 2225 only
- (2) DC voltage rating should not be exceeded in application. Other application factors may affect the MLCC performance. Consult for questions: [mlcc@vishay.com](mailto:mlcc@vishay.com)
- (3) Process code with 2 digits has to be added

## ENVIRONMENTAL STATUS

| TERMINATION CODE | TERMINATION DESCRIPTION                      | RoHS COMPLIANT | VISHAY GREEN |
|------------------|----------------------------------------------|----------------|--------------|
| X                | Ni barrier 100 % tin plated matte finish     | Yes            | Yes          |
| B                | Polymer layer, 100 % tin plated matte finish | Yes            | Yes          |

### DIMENSIONS in inches (millimeters)



| CASE CODE | STYLE  | LENGTH<br>(L)                   | WIDTH<br>(W)                    | MAXIMUM<br>THICKNESS<br>(T) | TERMINATION PAD<br>(P) |              |
|-----------|--------|---------------------------------|---------------------------------|-----------------------------|------------------------|--------------|
|           |        |                                 |                                 |                             | MINIMUM                | MAXIMUM      |
| 1206      | HV1206 | 0.126 ± 0.010<br>(3.20 ± 0.25)  | 0.063 ± 0.010<br>(1.60 ± 0.25)  | 0.067 (1.70)                | 0.010 (0.25)           | 0.030 (0.76) |
| 1210      | HV1210 | 0.126 ± 0.010<br>(3.20 ± 0.25)  | 0.098 ± 0.010<br>(2.50 ± 0.25)  | 0.067 (1.70)                | 0.010 (0.25)           | 0.030 (0.76) |
| 1808      | HV1808 | 0.180 ± 0.012<br>(4.57 ± 0.30)  | 0.080 ± 0.010<br>(2.03 ± 0.25)  | 0.086 (2.18)                | 0.010 (0.25)           | 0.035 (0.90) |
| 1812      | HV1812 | 0.177 ± 0.012<br>(4.50 ± 0.30)  | 0.126 ± 0.008<br>(3.20 ± 0.20)  | 0.106 (2.70)                | 0.010 (0.25)           | 0.035 (0.90) |
| 1825      | HV1825 | 0.177 ± 0.012<br>(4.50 ± 0.30)  | 0.252 ± 0.010<br>(6.40 ± 0.25)  | 0.106 (2.70)                | 0.010 (0.25)           | 0.035 (0.90) |
| 2220      | HV2220 | 0.220 ± 0.010<br>(5.59 ± 0.25)  | 0.200 ± 0.010<br>(5.08 ± 0.25)  | 0.106 (2.70)                | 0.010 (0.25)           | 0.037 (0.95) |
| 2225      | HV2225 | 0.220 ± 0.010<br>(5.59 ± 0.25)  | 0.250 ± 0.010<br>(6.35 ± 0.25)  | 0.106 (2.70)                | 0.010 (0.25)           | 0.037 (0.95) |
| 3040      | HV3040 | 0.300 ± 0.015<br>(7.62 ± 0.38)  | 0.400 ± 0.015<br>(10.20 ± 0.38) | 0.100 (2.54)                | 0.010 (0.25)           | 0.039 (1.00) |
| 3640      | HV3640 | 0.360 ± 0.015<br>(9.14 ± 0.38)  | 0.400 ± 0.015<br>(10.20 ± 0.38) | 0.130 (3.30)                | 0.010 (0.25)           | 0.037 (0.95) |
| 4044      | HV4044 | 0.400 ± 0.015<br>(10.16 ± 0.38) | 0.440 ± 0.015<br>(11.17 ± 0.38) | 0.120 (3.05)                | 0.020 (0.50)           | 0.040 (1.00) |

#### Note

- Polymer layer (B termination) have increased dimensions: length 0.006" (0.15 mm)



| SELECTION CHART            |        |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
|----------------------------|--------|-----------------------|-----|------|------|-----------------------|-----|------|------|------|-----------------------|-----|------|------|------|
| DIELECTRIC                 |        | C0G (NP0)             |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| STYLE                      |        | HV1206 <sup>(1)</sup> |     |      |      | HV1210 <sup>(1)</sup> |     |      |      |      | HV1808 <sup>(1)</sup> |     |      |      |      |
| EIA CODE                   |        | 1206                  |     |      |      | 1210                  |     |      |      |      | 1808                  |     |      |      |      |
| VOLTAGE (V <sub>DC</sub> ) |        | 500                   | 630 | 1000 | 1500 | 500                   | 630 | 1000 | 1500 | 2000 | 500                   | 630 | 1000 | 2000 | 3000 |
| VOLTAGE CODE               |        | E                     | L   | G    | R    | E                     | L   | G    | R    | F    | E                     | L   | G    | F    | H    |
| CAP. CODE                  | CAP.   |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 100                        | 10 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    | •    |                       |     |      |      |      |
| 120                        | 12 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    | •    |                       |     |      |      |      |
| 150                        | 15 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    | •    |                       |     |      |      |      |
| 180                        | 18 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    | •    |                       |     |      |      |      |
| 220                        | 22 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    | •    |                       |     |      |      |      |
| 270                        | 27 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    |
| 330                        | 33 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    |
| 390                        | 39 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    |
| 470                        | 47 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    |
| 560                        | 56 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    |
| 680                        | 68 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    |
| 820                        | 82 pF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    |
| 101                        | 100 pF | •                     | •   | •    | •    | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    |
| 121                        | 120 pF | •                     | •   | •    | •    | •                     | •   | •    | •    |      | •                     | •   | •    | •    |      |
| 151                        | 150 pF |                       |     |      |      |                       |     |      |      |      | •                     | •   | •    | •    |      |
| 181                        | 180 pF |                       |     |      |      |                       |     |      |      |      | •                     | •   | •    | •    |      |
| 221                        | 220 pF |                       |     |      |      |                       |     |      |      |      | •                     | •   | •    | •    |      |
| 271                        | 270 pF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 331                        | 330 pF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 391                        | 390 pF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 471                        | 470 pF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 561                        | 560 pF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 681                        | 680 pF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 821                        | 820 pF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 102                        | 1.0 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 122                        | 1.2 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 152                        | 1.5 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 182                        | 1.8 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 222                        | 2.2 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 272                        | 2.7 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 332                        | 3.3 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 392                        | 3.9 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |
| 472                        | 4.7 nF |                       |     |      |      |                       |     |      |      |      |                       |     |      |      |      |

**Notes**(1) See soldering recommendations within this data book, or visit: [www.vishay.com/doc?45034](http://www.vishay.com/doc?45034)

(2) Rating use lower packaging quantity, see "Standard Packaging Quantities" chart



| SELECTION CHART            |        |                       |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       |      |      |      |
|----------------------------|--------|-----------------------|-----|------|------|------|------|-----------------------|-----|-----|------|------|------|-----------------------|------|------|-----------------------|------|------|------|
| DIELECTRIC                 |        | C0G (NP0)             |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       |      |      |      |
| STYLE                      |        | HV1812 <sup>(1)</sup> |     |      |      |      |      | HV1825 <sup>(1)</sup> |     |     |      |      |      | HV2220 <sup>(1)</sup> |      |      | HV2225 <sup>(1)</sup> |      |      |      |
| EIA CODE                   |        | 1812                  |     |      |      |      |      | 1825                  |     |     |      |      |      | 2220                  |      |      | 2225                  |      |      |      |
| VOLTAGE (V <sub>DC</sub> ) |        | 500                   | 630 | 1000 | 2000 | 3000 | 4000 | 5000                  | 500 | 630 | 1000 | 3000 | 4000 | 5000                  | 3000 | 4000 | 5000                  | 3000 | 4000 | 5000 |
| VOLTAGE CODE               |        | E                     | L   | G    | F    | H    | V    | M                     | E   | L   | G    | H    | V    | M                     | H    | V    | M                     | H    | V    | M    |
| CAP. CODE                  | CAP.   |                       |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       |      |      |      |
| 100                        | 10 pF  |                       |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       |      |      |      |
| 120                        | 12 pF  |                       |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       |      |      |      |
| 150                        | 15 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    |      |      |                       |      |      |                       |      |      |      |
| 180                        | 18 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    |      |      |                       |      |      |                       |      |      |      |
| 220                        | 22 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    |      |      |                       |      |      |                       |      |      |      |
| 270                        | 27 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    |      |      |                       |      |      |                       |      |      |      |
| 330                        | 33 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    |                       |      |      |      |
| 390                        | 39 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    |                       |      |      |      |
| 470                        | 47 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 560                        | 56 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 680                        | 68 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 820                        | 82 pF  | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 101                        | 100 pF | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 121                        | 120 pF | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 151                        | 150 pF | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 181                        | 180 pF | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 221                        | 220 pF | •                     | •   | •    | •    | •    | •    | •                     | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 271                        | 270 pF | •                     | •   | •    | •    | •    | •    |                       | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 331                        | 330 pF | •                     | •   | •    | •    | •    |      |                       | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 391                        | 390 pF | •                     | •   | •    | •    | •    |      |                       | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 471                        | 470 pF | •                     | •   | •    | •    | •    |      |                       | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 561                        | 560 pF | •                     | •   | •    | •    | •    |      |                       | •   | •   | •    | •    | •    | •                     | •    | •    | •                     | •    | •    | •    |
| 681                        | 680 pF | •                     | •   | •    | •    | •    |      |                       | •   | •   | •    | •    | •    |                       | •    | •    |                       | •    | •    | •    |
| 821                        | 820 pF | •                     | •   | •    | •    | •    |      |                       | •   | •   | •    | •    |      |                       | •    |      |                       | •    | •    | •    |
| 102                        | 1.0 nF | •                     | •   | •    | •    | •    |      |                       | •   | •   | •    | •    |      |                       | •    |      |                       | •    | •    |      |
| 122                        | 1.2 nF | •                     | •   | •    |      |      |      |                       | •   | •   | •    | •    |      |                       | •    |      |                       | •    |      |      |
| 152                        | 1.5 nF | •                     | •   | •    |      |      |      |                       | •   | •   | •    | •    |      |                       | •    |      |                       | •    |      |      |
| 182                        | 1.8 nF | •                     | •   | •    |      |      |      |                       | •   | •   | •    | •    |      |                       | •    |      |                       | •    |      |      |
| 222                        | 2.2 nF |                       |     |      |      |      |      |                       | •   | •   | •    | •    |      |                       | •    |      |                       | •    |      |      |
| 272                        | 2.7 nF |                       |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       | •    |      |      |
| 332                        | 3.3 nF |                       |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       | •    |      |      |
| 392                        | 3.9 nF |                       |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       |      |      |      |
| 472                        | 4.7 nF |                       |     |      |      |      |      |                       |     |     |      |      |      |                       |      |      |                       |      |      |      |

## Notes

(1) See soldering recommendations within this data book, or visit: [www.vishay.com/doc?45034](http://www.vishay.com/doc?45034)

(2) Rating use lower packaging quantity, see "Standard Packaging Quantities" chart



| SELECTION CHART            |        |                       |     |      |      |      |                       |     |      |      |      |                       |     |      |      |      |      |      |
|----------------------------|--------|-----------------------|-----|------|------|------|-----------------------|-----|------|------|------|-----------------------|-----|------|------|------|------|------|
| DIELECTRIC                 |        | X7R                   |     |      |      |      |                       |     |      |      |      |                       |     |      |      |      |      |      |
| STYLE                      |        | HV1206 <sup>(1)</sup> |     |      |      |      | HV1210 <sup>(1)</sup> |     |      |      |      | HV1808 <sup>(1)</sup> |     |      |      |      |      |      |
| EIA CODE                   |        | 1206                  |     |      |      |      | 1210                  |     |      |      |      | 1808                  |     |      |      |      |      |      |
| VOLTAGE (V <sub>DC</sub> ) |        | 500                   | 630 | 1000 | 1500 | 2000 | 500                   | 630 | 1000 | 1500 | 2000 | 500                   | 630 | 1000 | 1500 | 2000 | 3000 | 6000 |
| VOLTAGE CODE               |        | E                     | L   | G    | R    | F    | E                     | L   | G    | R    | F    | E                     | L   | G    | R    | F    | H    | 6    |
| CAP. CODE                  | CAP.   |                       |     |      |      |      |                       |     |      |      |      |                       |     |      |      |      |      |      |
| 470                        | 47 pF  |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 560                        | 56 pF  |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 680                        | 68 pF  |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 820                        | 82 pF  |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 101                        | 100 pF |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 121                        | 120 pF |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 151                        | 150 pF |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 181                        | 180 pF |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 221                        | 220 pF |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 271                        | 270 pF | •                     | •   | •    | •    | •    |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 331                        | 330 pF | •                     | •   | •    | •    | •    |                       |     |      |      |      | •                     | •   | •    | •    | •    | •    | •    |
| 391                        | 390 pF | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 471                        | 470 pF | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 561                        | 560 pF | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 681                        | 680 pF | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 751                        | 750 pF |                       |     |      |      |      |                       |     |      |      |      |                       |     |      |      |      |      |      |
| 821                        | 820 pF | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 102                        | 1.0 nF | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 122                        | 1.2 nF | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 152                        | 1.5 nF | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 182                        | 1.8 nF | •                     | •   | •    | •    |      | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 222                        | 2.2 nF | •                     | •   | •    |      |      | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 272                        | 2.7 nF | •                     | •   | •    |      |      | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 332                        | 3.3 nF | •                     | •   | •    |      |      | •                     | •   | •    | •    | •    | •                     | •   | •    | •    | •    | •    |      |
| 392                        | 3.9 nF | •                     | •   | •    |      |      | •                     | •   | •    | •    |      | •                     | •   | •    | •    |      |      |      |
| 472                        | 4.7 nF | •                     | •   | •    |      |      | •                     | •   | •    | •    |      | •                     | •   | •    | •    |      |      |      |
| 562                        | 5.6 nF |                       |     |      |      |      | •                     | •   | •    |      |      | •                     | •   | •    | •    |      |      |      |
| 682                        | 6.8 nF |                       |     |      |      |      | •                     | •   | •    |      |      | •                     | •   | •    | •    |      |      |      |
| 822                        | 8.2 nF |                       |     |      |      |      | •                     | •   |      |      |      | •                     | •   | •    |      |      |      |      |
| 103                        | 10 nF  |                       |     |      |      |      | •                     | •   |      |      |      | •                     | •   | •    |      |      |      |      |
| 123                        | 12 nF  |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    |      |      |      |      |
| 153                        | 15 nF  |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    |      |      |      |      |
| 183                        | 18 nF  |                       |     |      |      |      |                       |     |      |      |      | •                     | •   | •    |      |      |      |      |

**Notes**

<sup>(1)</sup> See soldering recommendations within this data book, or visit: [www.vishay.com/doc?45034](http://www.vishay.com/doc?45034)

<sup>(2)</sup> Rating use lower packaging quantity, see "Standard Packaging Quantities" chart



| SELECTION CHART            |        |                       |     |      |      |      |                  |                  |      |      |                       |     |      |      |      |                  |      |
|----------------------------|--------|-----------------------|-----|------|------|------|------------------|------------------|------|------|-----------------------|-----|------|------|------|------------------|------|
| DIELECTRIC                 |        | X7R                   |     |      |      |      |                  |                  |      |      |                       |     |      |      |      |                  |      |
| STYLE                      |        | HV1812 <sup>(1)</sup> |     |      |      |      |                  |                  |      |      | HV1825 <sup>(1)</sup> |     |      |      |      |                  |      |
| EIA CODE                   |        | 1812                  |     |      |      |      |                  |                  |      |      | 1825                  |     |      |      |      |                  |      |
| VOLTAGE (V <sub>DC</sub> ) |        | 500                   | 630 | 1000 | 1500 | 2000 | 3000             | 4000             | 5000 | 6000 | 500                   | 630 | 1000 | 1500 | 2000 | 3000             | 4000 |
| VOLTAGE CODE               |        | E                     | L   | G    | R    | F    | H                | V                | M    | 6    | E                     | L   | G    | R    | F    | H                | V    |
| CAP. CODE                  | CAP.   |                       |     |      |      |      |                  |                  |      |      |                       |     |      |      |      |                  |      |
| 101                        | 100 pF |                       |     |      |      |      |                  |                  |      |      |                       |     |      |      |      |                  |      |
| 121                        | 120 pF |                       |     |      |      |      |                  |                  |      |      |                       |     |      |      |      |                  |      |
| 151                        | 150 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    |                       |     |      |      |      |                  |      |
| 181                        | 180 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    |                       |     |      |      |      |                  |      |
| 221                        | 220 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    |                       |     |      |      |      |                  |      |
| 271                        | 270 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    |                       |     |      |      |      |                  |      |
| 331                        | 330 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    | •                     | •   | •    | •    | •    | •                | •    |
| 391                        | 390 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    | •                     | •   | •    | •    | •    | •                | •    |
| 471                        | 470 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    | •                     | •   | •    | •    | •    | •                | •    |
| 561                        | 560 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    | •                     | •   | •    | •    | •    | •                | •    |
| 681                        | 680 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    | •                     | •   | •    | •    | •    | •                | •    |
| 751                        | 750 pF | •                     | •   | •    | •    | •    | •                | •                | •    | •    |                       |     |      |      |      |                  |      |
| 821                        | 820 pF | •                     | •   | •    | •    | •    | •                | •                | •    |      | •                     | •   | •    | •    | •    | •                | •    |
| 102                        | 1.0 nF | •                     | •   | •    | •    | •    | •                | •                |      |      | •                     | •   | •    | •    | •    | •                | •    |
| 122                        | 1.2 nF | •                     | •   | •    | •    | •    | •                | •                |      |      | •                     | •   | •    | •    | •    | •                | •    |
| 152                        | 1.5 nF | •                     | •   | •    | •    | •    | •                | • <sup>(2)</sup> |      |      | •                     | •   | •    | •    | •    | •                | •    |
| 182                        | 1.8 nF | •                     | •   | •    | •    | •    | •                |                  |      |      | •                     | •   | •    | •    | •    | •                | •    |
| 222                        | 2.2 nF | •                     | •   | •    | •    | •    | •                |                  |      |      | •                     | •   | •    | •    | •    | •                | •    |
| 272                        | 2.7 nF | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |                  |      |      | •                     | •   | •    | •    | •    | •                | •    |
| 332                        | 3.3 nF | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |                  |      |      | •                     | •   | •    | •    | •    | •                | •    |
| 392                        | 3.9 nF | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |                  |      |      | •                     | •   | •    | •    | •    | •                |      |
| 472                        | 4.7 nF | •                     | •   | •    | •    | •    |                  |                  |      |      | •                     | •   | •    | •    | •    | •                |      |
| 562                        | 5.6 nF | •                     | •   | •    | •    | •    |                  |                  |      |      | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |      |
| 682                        | 6.8 nF | •                     | •   | •    | •    | •    |                  |                  |      |      | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |      |
| 822                        | 8.2 nF | •                     | •   | •    | •    |      |                  |                  |      |      | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |      |
| 103                        | 10 nF  | •                     | •   | •    | •    |      |                  |                  |      |      | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |      |
| 123                        | 12 nF  | •                     | •   | •    | •    |      |                  |                  |      |      | •                     | •   | •    | •    | •    |                  |      |
| 153                        | 15 nF  | •                     | •   | •    | •    |      |                  |                  |      |      | •                     | •   | •    | •    | •    |                  |      |
| 183                        | 18 nF  | •                     | •   | •    | •    |      |                  |                  |      |      | •                     | •   | •    | •    | •    |                  |      |
| 223                        | 22 nF  | •                     | •   | •    |      |      |                  |                  |      |      | •                     | •   | •    | •    | •    |                  |      |
| 273                        | 27 nF  | •                     | •   | •    |      |      |                  |                  |      |      | •                     | •   | •    | •    | •    |                  |      |
| 333                        | 33 nF  |                       |     |      |      |      |                  |                  |      |      | •                     | •   | •    | •    |      |                  |      |
| 393                        | 39 nF  |                       |     |      |      |      |                  |                  |      |      | •                     | •   | •    | •    |      |                  |      |
| 473                        | 47 nF  |                       |     |      |      |      |                  |                  |      |      | •                     | •   | •    |      |      |                  |      |
| 563                        | 56 nF  |                       |     |      |      |      |                  |                  |      |      | •                     | •   | •    |      |      |                  |      |
| 683                        | 68 nF  |                       |     |      |      |      |                  |                  |      |      |                       |     |      |      |      |                  |      |
| 823                        | 82 nF  |                       |     |      |      |      |                  |                  |      |      |                       |     |      |      |      |                  |      |

**Notes**(1) See soldering recommendations within this data book, or visit: [www.vishay.com/doc?45034](http://www.vishay.com/doc?45034)

(2) Rating use lower packaging quantity, see "Standard Packaging Quantities" chart



| SELECTION CHART            |        |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
|----------------------------|--------|-----------------------|-----|------|------|------|------------------|------|------|------|-----------------------|-----|------|------|------|------|------|------|------|
| DIELECTRIC                 |        | X7R                   |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| STYLE                      |        | HV2220 <sup>(1)</sup> |     |      |      |      |                  |      |      |      | HV2225 <sup>(1)</sup> |     |      |      |      |      |      |      |      |
| EIA CODE                   |        | 2220                  |     |      |      |      |                  |      |      |      | 2225                  |     |      |      |      |      |      |      |      |
| VOLTAGE (V <sub>DC</sub> ) |        | 500                   | 630 | 1000 | 1500 | 2000 | 3000             | 4000 | 5000 | 6000 | 500                   | 630 | 1000 | 1500 | 2000 | 3000 | 4000 | 5000 | 6000 |
| VOLTAGE CODE               |        | E                     | L   | G    | R    | F    | H                | V    | M    | 6    | E                     | L   | G    | R    | F    | H    | V    | M    | 6    |
| CAP. CODE                  | CAP.   |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| 101                        | 100 pF |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| 121                        | 120 pF |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| 151                        | 150 pF |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| 181                        | 180 pF |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| 221                        | 220 pF |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| 271                        | 270 pF |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| 331                        | 330 pF |                       |     |      |      |      |                  |      |      |      |                       |     |      |      |      |      |      |      |      |
| 391                        | 390 pF | •                     | •   | •    | •    | •    | •                | •    | •    |      |                       |     |      |      |      |      |      |      |      |
| 471                        | 470 pF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 561                        | 560 pF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 681                        | 680 pF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 751                        | 750 pF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 821                        | 820 pF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 102                        | 1.0 nF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 122                        | 1.2 nF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 152                        | 1.5 nF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 182                        | 1.8 nF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 222                        | 2.2 nF | •                     | •   | •    | •    | •    | •                | •    | •    | •    | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 272                        | 2.7 nF | •                     | •   | •    | •    | •    | •                | •    |      |      | •                     | •   | •    | •    | •    | •    | •    | •    | •    |
| 332                        | 3.3 nF | •                     | •   | •    | •    | •    | •                | •    |      |      | •                     | •   | •    | •    | •    | •    | •    | •    |      |
| 392                        | 3.9 nF | •                     | •   | •    | •    | •    | •                |      |      |      | •                     | •   | •    | •    | •    | •    | •    |      |      |
| 472                        | 4.7 nF | •                     | •   | •    | •    | •    | •                |      |      |      | •                     | •   | •    | •    | •    | •    | •    |      |      |
| 562                        | 5.6 nF | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |      |      |      | •                     | •   | •    | •    | •    | •    | •    |      |      |
| 682                        | 6.8 nF | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |      |      |      | •                     | •   | •    | •    | •    | •    |      |      |      |
| 822                        | 8.2 nF | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |      |      |      | •                     | •   | •    | •    | •    | •    |      |      |      |
| 103                        | 10 nF  | •                     | •   | •    | •    | •    | • <sup>(2)</sup> |      |      |      | •                     | •   | •    | •    | •    | •    |      |      |      |
| 123                        | 12 nF  | •                     | •   | •    | •    | •    |                  |      |      |      | •                     | •   | •    | •    | •    | •    |      |      |      |
| 153                        | 15 nF  | •                     | •   | •    | •    | •    |                  |      |      |      | •                     | •   | •    | •    | •    | •    |      |      |      |
| 183                        | 18 nF  | •                     | •   | •    | •    | •    |                  |      |      |      | •                     | •   | •    | •    | •    |      |      |      |      |
| 223                        | 22 nF  | •                     | •   | •    | •    | •    |                  |      |      |      | •                     | •   | •    | •    | •    |      |      |      |      |
| 273                        | 27 nF  | •                     | •   | •    | •    | •    |                  |      |      |      | •                     | •   | •    | •    | •    |      |      |      |      |
| 333                        | 33 nF  | •                     | •   | •    |      |      |                  |      |      |      | •                     | •   | •    | •    | •    |      |      |      |      |
| 393                        | 39 nF  | •                     | •   | •    |      |      |                  |      |      |      | •                     | •   | •    | •    | •    |      |      |      |      |
| 473                        | 47 nF  | •                     | •   | •    |      |      |                  |      |      |      | •                     | •   | •    | •    | •    |      |      |      |      |
| 563                        | 56 nF  | •                     | •   | •    |      |      |                  |      |      |      | •                     | •   | •    | •    |      |      |      |      |      |
| 683                        | 68 nF  | •                     | •   | •    |      |      |                  |      |      |      | •                     | •   | •    | •    |      |      |      |      |      |
| 823                        | 82 nF  | •                     | •   | •    |      |      |                  |      |      |      | •                     | •   | •    |      |      |      |      |      |      |
| 104                        | 100 nF |                       |     |      |      |      |                  |      |      |      | •                     | •   | •    |      |      |      |      |      |      |

**Notes**

<sup>(1)</sup> See soldering recommendations within this data book, or visit: [www.vishay.com/doc?45034](http://www.vishay.com/doc?45034)

<sup>(2)</sup> Rating use lower packaging quantity, see "Standard Packaging Quantities" chart





## SELECTION CHART

| DIELECTRIC                 |        | X7R                   |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
|----------------------------|--------|-----------------------|-----|------|------|-----------------------|-----|------|------|------|------|-----------------------|-----|------|------|
| STYLE                      |        | HV3040 <sup>(1)</sup> |     |      |      | HV3640 <sup>(1)</sup> |     |      |      |      |      | HV4044 <sup>(1)</sup> |     |      |      |
| EIA CODE                   |        | 3040                  |     |      |      | 3640                  |     |      |      |      |      | 4044                  |     |      |      |
| VOLTAGE (V <sub>DC</sub> ) |        | 500                   | 630 | 1000 | 1500 | 500                   | 630 | 1000 | 1500 | 6000 | 8000 | 500                   | 630 | 1000 | 1500 |
| VOLTAGE CODE               |        | E                     | L   | G    | R    | E                     | L   | G    | R    | 6    | 8    | E                     | L   | G    | R    |
| CAP. CODE                  | CAP.   |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 101                        | 100 pF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 121                        | 120 pF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 151                        | 150 pF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 181                        | 180 pF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 221                        | 220 pF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 271                        | 270 pF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 331                        | 330 pF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 391                        | 390 pF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 471                        | 470 pF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 561                        | 560 pF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 681                        | 680 pF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 751                        | 750 pF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 821                        | 820 pF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 102                        | 1.0 nF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 122                        | 1.2 nF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 152                        | 1.5 nF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 182                        | 1.8 nF |                       |     |      |      | •                     | •   | •    | •    | •    | •    |                       |     |      |      |
| 222                        | 2.2 nF |                       |     |      |      | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 272                        | 2.7 nF |                       |     |      |      | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 332                        | 3.3 nF |                       |     |      |      | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 392                        | 3.9 nF |                       |     |      |      | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 472                        | 4.7 nF |                       |     |      |      | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 562                        | 5.6 nF |                       |     |      |      | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 682                        | 6.8 nF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 822                        | 8.2 nF |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 103                        | 10 nF  |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 123                        | 12 nF  |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 153                        | 15 nF  |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 183                        | 18 nF  |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 223                        | 22 nF  |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 273                        | 27 nF  |                       |     |      |      |                       |     |      |      |      |      |                       |     |      |      |
| 333                        | 33 nF  | •                     | •   | •    | •    |                       |     |      |      |      |      |                       |     |      |      |
| 393                        | 39 nF  | •                     | •   | •    | •    |                       |     |      |      |      |      |                       |     |      |      |
| 473                        | 47 nF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 563                        | 56 nF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 683                        | 68 nF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 823                        | 82 nF  | •                     | •   | •    | •    | •                     | •   | •    | •    |      |      |                       |     |      |      |
| 104                        | 100 nF | •                     | •   | •    | •    | •                     | •   | •    | •    |      |      | •                     | •   | •    | •    |
| 124                        | 120 nF | •                     | •   | •    | •    | •                     | •   | •    | •    |      |      | •                     | •   | •    | •    |
| 154                        | 150 nF | •                     | •   | •    |      | •                     | •   | •    | •    |      |      | •                     | •   | •    | •    |
| 184                        | 180 nF | •                     | •   | •    |      | •                     | •   | •    | •    |      |      | •                     | •   | •    | •    |
| 224                        | 220 nF | •                     | •   | •    |      | •                     | •   | •    | •    |      |      | •                     | •   | •    | •    |
| 274                        | 270 nF |                       |     |      |      | •                     | •   | •    | •    |      |      | •                     | •   | •    | •    |
| 334                        | 330 nF |                       |     |      |      | •                     | •   | •    |      |      |      | •                     | •   | •    | •    |
| 394                        | 390 nF |                       |     |      |      | •                     | •   |      |      |      |      | •                     | •   | •    |      |
| 474                        | 470 nF |                       |     |      |      |                       |     |      |      |      |      | •                     | •   | •    |      |
| 564                        | 560 nF |                       |     |      |      |                       |     |      |      |      |      | •                     | •   | •    |      |

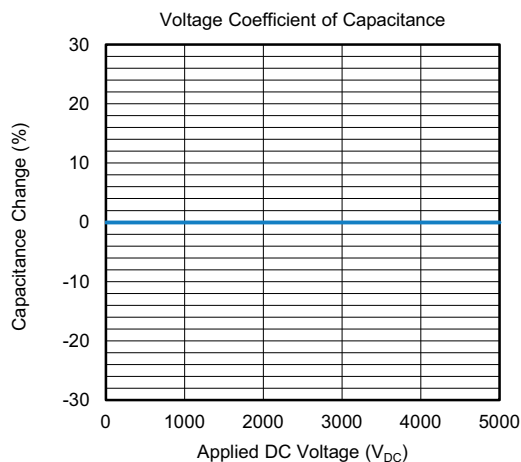
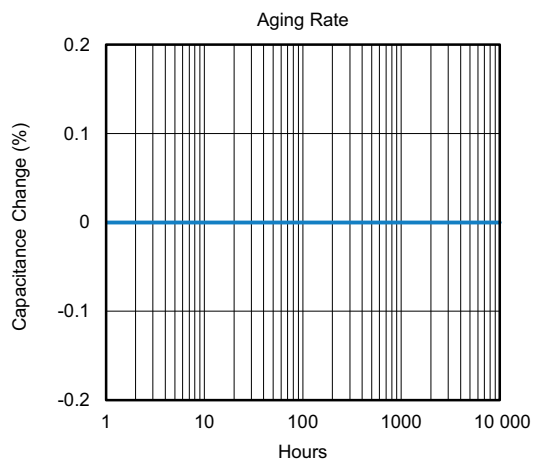
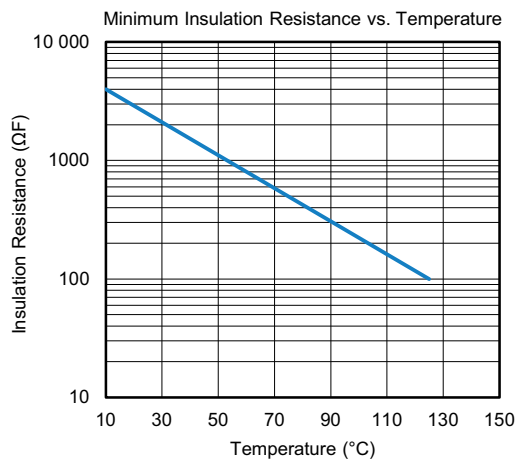
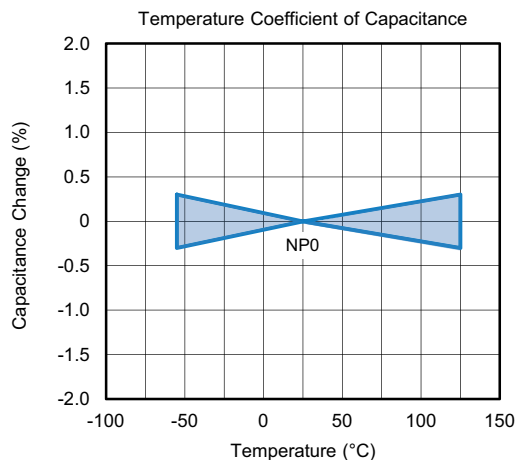
## Notes

(1) See soldering recommendations within this data book, or visit: [www.vishay.com/doc?45034](http://www.vishay.com/doc?45034)

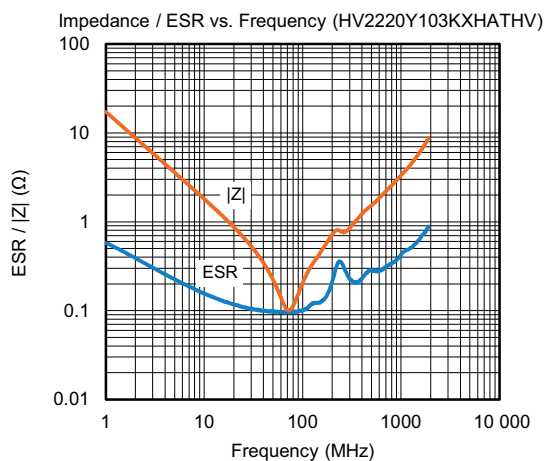
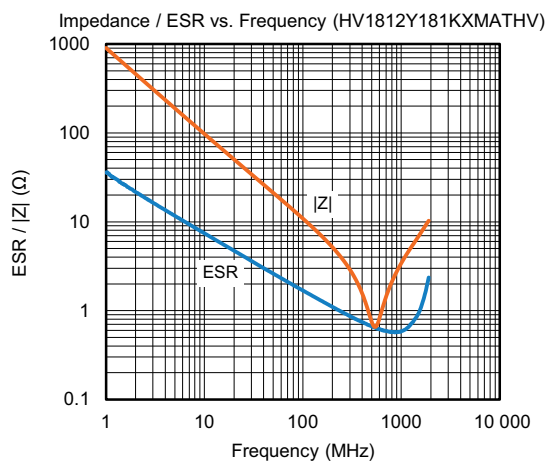
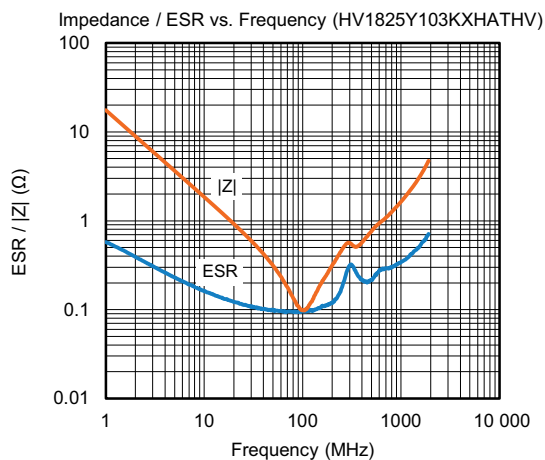
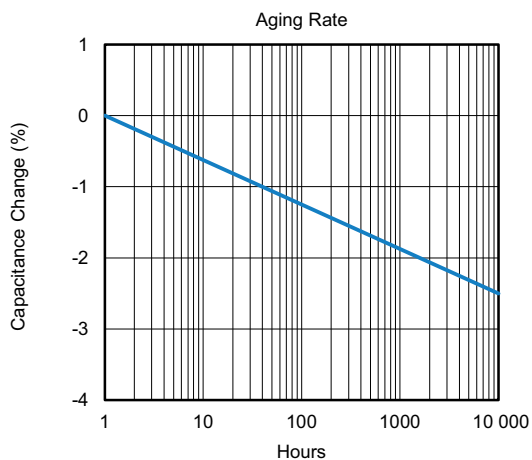
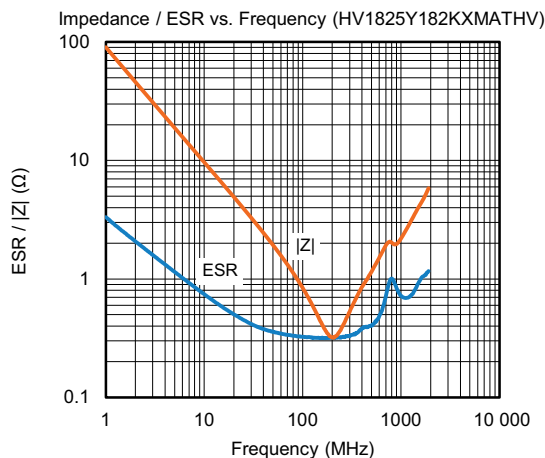
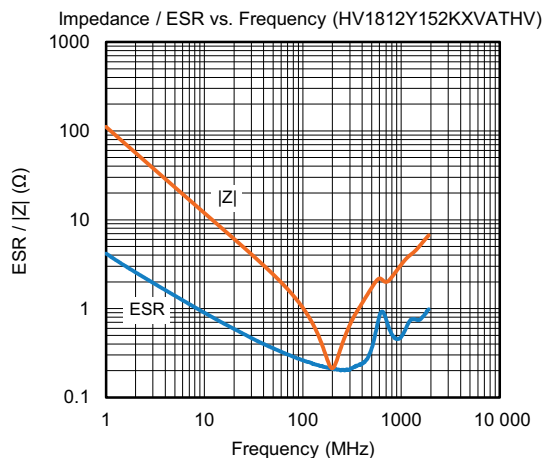
(2) Rating use lower packaging quantity, see "Standard Packaging Quantities" chart



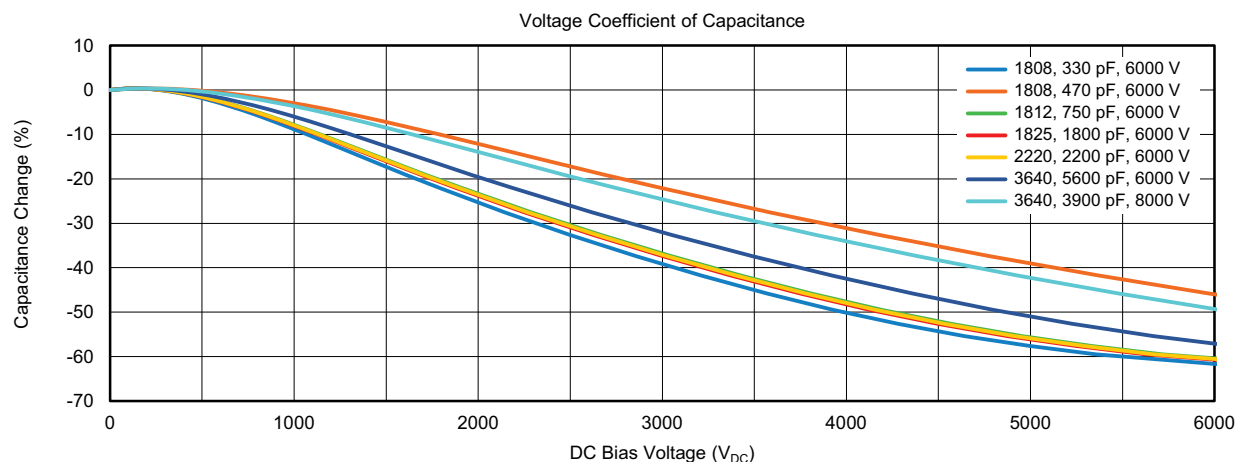
## COG (NP0) DIELECTRIC - TYPICAL PARAMETERS



## X7R DIELECTRIC - TYPICAL PARAMETERS



## X7R DIELECTRIC - TYPICAL PARAMETERS

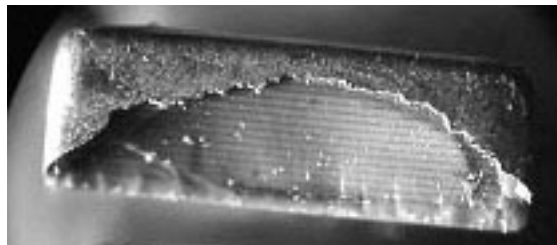


## POLYMER TERMINATION

Polymer termination provides additional protection against board flexure damage by absorbing greater mechanical and thermal stresses. Components can be packaged, transported, stored and handled the same standard terminated product. Reflow soldering of MLCC does not require modification to equipment and / or process. Polymer termination greatly reduces the risk of mechanical cracking however it does not completely eliminate.

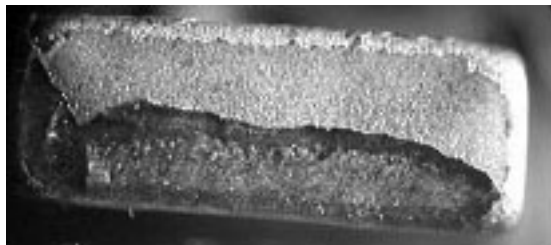
## STANDARD TERMINATION

Exposed Electrodes = Electrical Short



## OMD CAP PLUS POLYMER TERMINATION

No Exposed Electrodes = No Electrical Short



## STANDARD PACKAGING QUANTITIES <sup>(1)</sup>

| CASE CODE | TAPE SIZE | 7" REEL QUANTITIES<br>PACKAGING CODE "T" | 11 1/4" AND 13" REEL QUANTITIES<br>PACKAGING CODE "R" |
|-----------|-----------|------------------------------------------|-------------------------------------------------------|
| 1206      | 8 mm      | 2500 / 3000                              | 9000 / 10 000                                         |
| 1210      | 8 mm      | 2000 / 2500 / 3000                       | 9000 / 10 000                                         |
| 1808      | 12 mm     | 2000                                     | 10 000                                                |
| 1812      | 12 mm     | 500 <sup>(2)</sup> / 1000                | 4000                                                  |
| 1825      | 12 mm     | 500 <sup>(2)</sup> / 1000                | 4000                                                  |
| 2220      | 12 mm     | 500 <sup>(2)</sup> / 1000                | n/a                                                   |
| 2225      | 12 mm     | 500                                      | n/a                                                   |
| 3040      | 16 mm     | 500                                      | n/a                                                   |
| 3640      | 16 mm     | 500                                      | n/a                                                   |
| 4044      | 24 mm     | 300                                      | n/a                                                   |

### Notes

<sup>(1)</sup> Reference: EIA standard RS 481 - "Taping of Surface Mount Components for Automatic Placement"

<sup>(2)</sup> Lower quantity for certain ratings, see "Selection Chart"



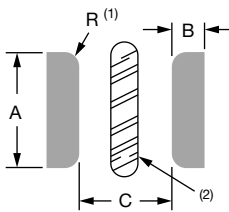
## STORAGE AND HANDLING CONDITIONS

- (1) Store the components at 5 °C to 40 °C ambient temperature and  $\leq 70$  % relative humidity conditions.
- (2) The product is recommended to be used within a time-frame of 2 years after shipment.  
Check solderability in case extended shelf life beyond the expiry date is needed.

### Precautions:

- a. Do not store products in an environment containing corrosive elements, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. This may cause corrosion or oxidization of the terminations, which can easily lead to poor soldering.
- b. Store products on the shelf and avoid exposure to moisture or dust.
- c. Do not expose products to excessive shock, vibration, direct sunlight and so on.

## Solder Pad Dimensions for Vishay Surface-Mount Multilayer Ceramic Chip Capacitors

| DIMENSIONS in millimeters                                                         |                     |      |                     |
|-----------------------------------------------------------------------------------|---------------------|------|---------------------|
|  |                     |      |                     |
| CASE CODE                                                                         | A                   | B    | C                   |
| 0402                                                                              | 0.50                | 0.50 | 0.40                |
| 0505                                                                              | 1.35                | 1.00 | 0.60                |
| 0603                                                                              | 0.90                | 1.00 | 1.00 <sup>(3)</sup> |
| 0805                                                                              | 1.30                | 1.20 | 1.00                |
| 1111                                                                              | 2.90                | 1.30 | 1.75                |
| 1206                                                                              | 1.80                | 1.20 | 2.10                |
| 1210                                                                              | 2.80                | 1.30 | 1.90                |
| 1808                                                                              | 2.40                | 1.50 | 3.00                |
| 1812                                                                              | 3.60                | 1.50 | 3.00                |
| 1825                                                                              | 6.50                | 1.50 | 3.00                |
| 2008                                                                              | 2.70                | 1.50 | 4.08                |
| 2220                                                                              | 5.50 <sup>(4)</sup> | 1.50 | 4.20                |
| 2225                                                                              | 6.50                | 1.50 | 4.20                |
| 2525                                                                              | 6.60                | 1.50 | 4.50                |
| 3040                                                                              | 10.80               | 2.00 | 5.50                |
| 3640                                                                              | 10.80               | 2.00 | 7.00                |
| 3838                                                                              | 10.20               | 2.00 | 7.50                |
| 4044                                                                              | 12.30               | 2.00 | 8.00                |

### Notes

- <sup>(1)</sup> For safety capacitors and voltages above 3000 V, corner rounding (R) of 0.5 mm is recommended to suppress arcing
- <sup>(2)</sup> Add a 1 mm slot in PCB between pads to allow cleaning and coating under MLCC
- <sup>(3)</sup> For VJ HiFREQ Series, this dimension is 0.6 mm
- <sup>(4)</sup> For safety capacitors, the A dimension should be 5.80 mm



## PRINTED CIRCUIT BOARD PCB DESIGN CONSIDERATIONS FOR HIGH VOLTAGE SURFACE-MOUNT MLCCS

Special assembly process and design considerations should be employed for today's high voltage rating MLCCs. As case sizes remain the same and voltage ratings increase, MLCC manufacturers must design, evaluate, and qualify their capacitors using methods that reduce the occurrence of corona discharge and arcover events. To meet similar capability in high voltage applications, users should employ similar cautionary design and assembly methods.

### MLCC PAD LAYOUT

A capacitor's arcover inception point can degrade due to factors such as the MLCC termination, PCB pad design, PCB cleanliness, solder flux residue, surface contamination / deposits and environmental conditions. PCB pads and their design affect the air gap distance between the opposing polarities of the MLCC termination. For voltage rating greater than 1500 V<sub>DC</sub> add a corner radius to the inward facing edge of the MLCC pads and as large a gap as possible between the pads. Too small of a pad gap distance will reduce the capacitor's own arcover inception voltage level. Refer to the Figure and Table Figure 1.0, MLCC Pad Layout and Table 1.0, Vishay MLCC Solder Pad Dimensions for the recommended MLCC solder pad dimensions.

### SLOT OR TRENCH BETWEEN PADS

PCB assembly can deposit dust, trap solder balls, or flux residue underneath the capacitors. These contaminants will reduce conductive clearances and the arcover inception level. Assembly methods must include a final PCB cleaning process. A slot or trench can be cut into the PCB in between the pads to allow cleaners to penetrate underneath the MLCC. The slot will also allow conformal or epoxy coatings to flow underneath the MLCC and build an insulative barrier between pads. Refer to Figure 1.0 MLCC Pad Layout for slot reference location.

### COATING PRINTED CIRCUIT BOARD

Coating a printed circuit board with materials such as acrylic, silicone and urethane resins provide a protective dielectric barrier that is non-conductive and will enhance the resistance to arcing. Various processes exist which include dipping, brushing, and spraying. Optimal performance will come from coating the MLCC on all sides, top and bottom. The PCB slot in between the pads should extend slightly beyond the width of the MLCC. Refer to Figure 1.0 MLCC Pad Layout for slot reference location.



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