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

## FEATURES

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

Pb-free

RoHS COMPLIANT

HALOGEN FREE GREEN (5-2008)

## 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

## ELECTRICAL SPECIFICATIONS

### X7R

**GENERAL SPECIFICATION**

**Note**
Electrical characteristics at +25 °C unless otherwise specified

**Operating Temperature:** -55 °C to +125 °C

**Capacitance Range:** 180 pF to 15 nF

**Voltage Range:** 3000 $V_{DC}$, 4000 $V_{DC}$, 5000 $V_{DC}$

**Temperature Coefficient of Capacitance (TCC):**
± 15 % from -55 °C to +125 °C, with 0 $V_{DC}$ applied

**Dissipation Factor (DF):**
2.5 % maximum at 1.0 $V_{RMS}$ and 1 kHz

**Insulating Resistance:**
at +25 °C 100 000 MΩ min. or 1000 ΩF whichever is less
at +125 °C 10 000 MΩ min. or 100 ΩF whichever is less

**Aging Rate:** 1 % maximum per decade

**Dielectric Strength Test:**
performed per method 103 of EIA 198-2-E
Applied test voltages
3000 $V_{DC}$- / 4000 $V_{DC}$- / 5000 $V_{DC}$-rated:
min. 120 % of rated voltage



For technical questions, contact: mlcc@vishay.com

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## QUICK REFERENCE DATA

| DIELECTRIC | CASE | MAXIMUM VOLTAGE (V) | CAPACITANCE | |
|---|---|---|---|---|
| | | | MINIMUM | MAXIMUM |
| X7R | 1812 | 5000 | 180 pF | 3.9 nF |
| | 1825 | 5000 | 330 pF | 10 nF |
| | 2220 | 5000 | 390 pF | 10 nF |
| | 2225 | 5000 | 470 pF | 15 nF |

**Note**

- Detail ratings see “Selection Chart”

## ORDERING INFORMATION

| HV2220 | Y | 152 | K | X | M | A | T | HV [2] |
|---|---|---|---|---|---|---|---|---|
| CASE CODE | DIELECTRIC | CAPACITANCE NOMINAL CODE | CAPACITANCE TOLERANCE | TERMINATION | DC VOLTAGE RATING [1] | MARKING | PACKAGING | PROCESS CODE |
| 1812<br>1825<br>2220<br>2225 | Y = X7R | Expressed in picofarads (pF). The first two digits are significant, the third is a multiplier. **Examples** 152 = 1500 pF | J = ± 5 %<br>K = ± 10 %<br>M = ± 20 % | X = Ni barrier 100 % tin plated matte finish | H = 3000 V<br>V = 4000 V<br>M = 5000 V | A = unmarked | T = 7" reel / plastic tape<br>R = 11 1/4" / 13" reel / plastic tape | HV = high voltage |

**Notes**

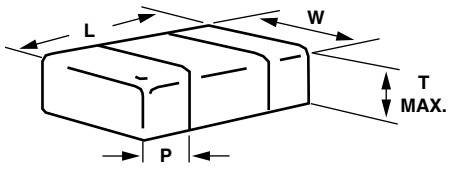
(1) DC voltage rating should not be exceeded in application. Other application factors may affect the MLCC performance. Consult for questions: mlcc@vishay.com

(2) 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 |

## DIMENSIONS in inches (millimeters)




| CASE CODE | STYLE | LENGTH (L) | WIDTH (W) | MAXIMUM THICKNESS (T) | TERMINATION PAD (P) | |
|---|---|---|---|---|---|---|
| | | | | | MINIMUM | MAXIMUM |
| 1812 | HV1812 | 0.177 ± 0.012 (4.50 ± 0.30) | 0.126 ± 0.008 (3.20 ± 0.20) | 0.106 (2.70) | 0.010 (0.25) | 0.030 (0.76) |
| 1825 | HV1825 | 0.177 ± 0.012 (4.50 ± 0.30) | 0.252 ± 0.010 (6.40 ± 0.25) | 0.106 (2.70) | 0.010 (0.25) | 0.030 (0.76) |
| 2220 | HV2220 | 0.220 ± 0.010 (5.59 ± 0.25) | 0.200 ± 0.010 (5.08 ± 0.25) | 0.106 (2.70) | 0.010 (0.25) | 0.030 (0.76) |
| 2225 | HV2225 | 0.220 ± 0.010 (5.59 ± 0.25) | 0.250 ± 0.010 (6.35 ± 0.25) | 0.106 (2.70) | 0.010 (0.25) | 0.030 (0.76) |



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| SELECTION CHART | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| DIELECTRIC | | X7R | | | | | | | | | | | |
| STYLE | | HV1812 (1) | | | HV1825 (1) | | | HV2220 (1) | | | HV2225 (1) | | |
| EIA CODE | | 1812 | | | 1825 | | | 2220 | | | 2225 | | |
| VOLTAGE ($V_{DC}$) | | 3000 | 4000 | 5000 | 3000 | 4000 | 5000 | 3000 | 4000 | 5000 | 3000 | 4000 | 5000 |
| VOLTAGE CODE | | H | V | M | H | V | M | H | V | M | H | V | M |
| 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 | • | • | • | | • | • | | • | • | | • | • |
| 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 | | | | | | | | | | | | |

**Note**

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



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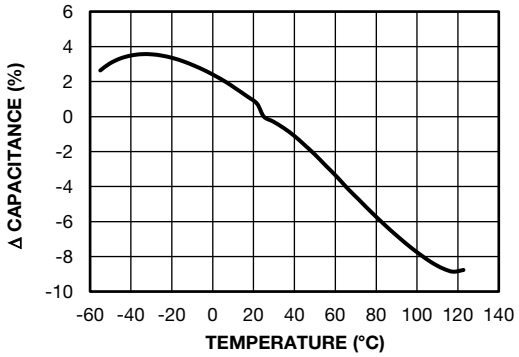
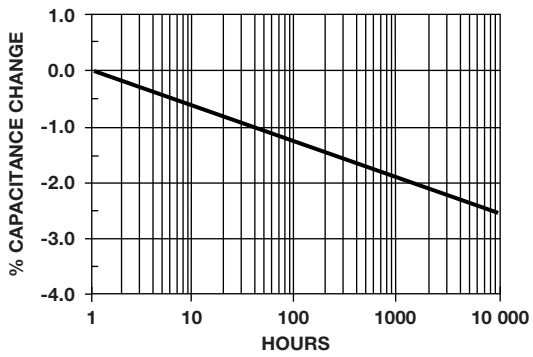
## X7R DIELECTRIC - TYPICAL PARAMETERS

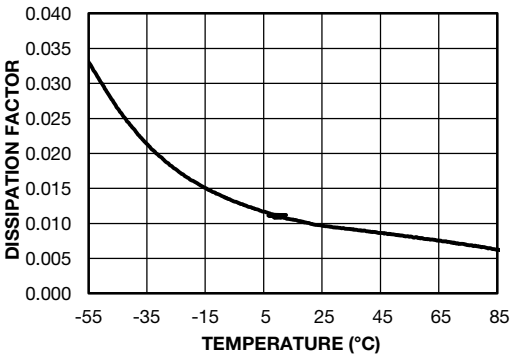
### TEMPERATURE COEFFICIENT OF CAPACITANCE



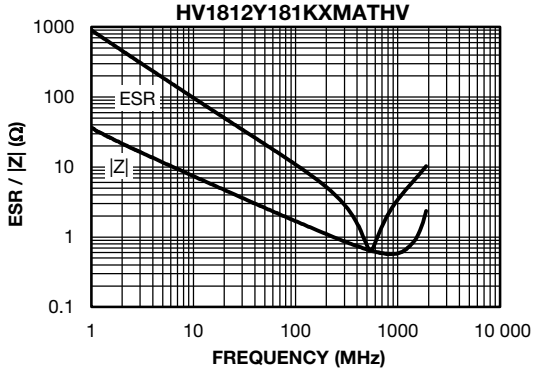

### AGING RATE




### DISSIPATION FACTOR VS. TEMPERATURE




### IMPEDANCE / ESR VS. FREQUENCY HV1812Y181KXMATHV

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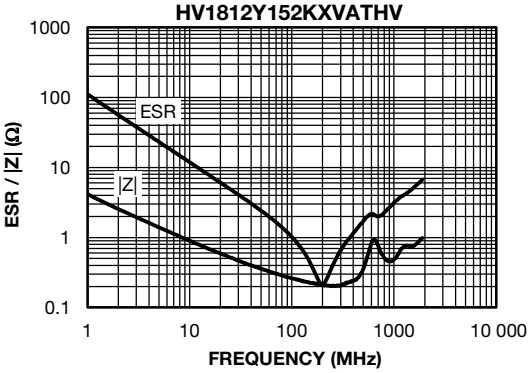


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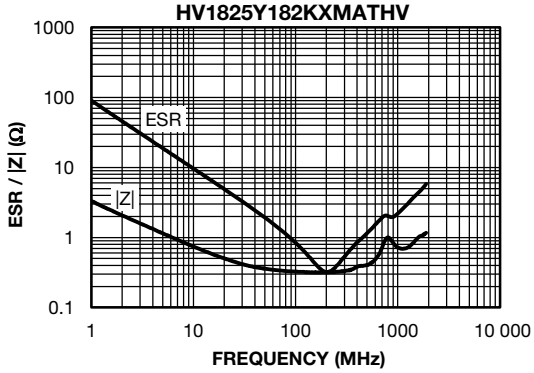




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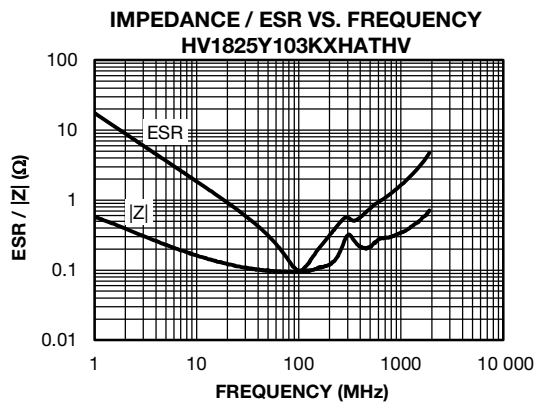
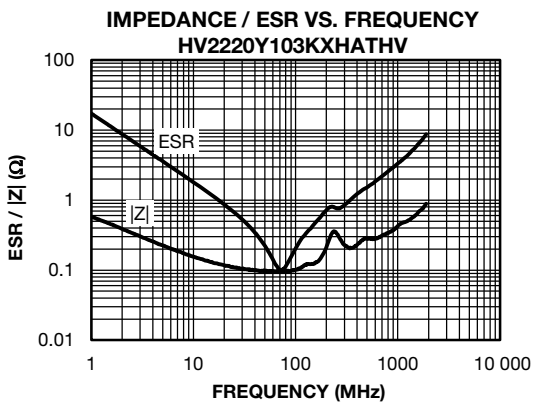
## X7R DIELECTRIC - TYPICAL PARAMETERS




## STANDARD PACKAGING QUANTITIES (1)

| CASE CODE | TAPE SIZE | 7" REEL QUANTITIES PACKAGING CODE "T" | 11 1/4" AND 13" REEL QUANTITIES PACKAGING CODE "R" |
|---|---|---|---|
| 1812 | 12 mm | 1000 | 4000 |
| 1825 | 12 mm | 1000 | 4000 |
| 2220 | 12 mm | 1000 | 4000 |
| 2225 | 12 mm | 500 | 4000 |

**Note**

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

## STORAGE AND HANDLING CONDITIONS

(1) Store the components at 5 °C to 40 °C ambient temperature and ≤ 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.



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