

## AC Line Rated Ceramic Disc Capacitors

### Class X1, 760 V<sub>AC</sub>, Class Y1, 500 V<sub>AC</sub>



#### ADDITIONAL RESOURCES



| QUICK REFERENCE DATA       |        |     |               |               |
|----------------------------|--------|-----|---------------|---------------|
| DESCRIPTION                | VALUE  |     |               |               |
| Ceramic Class              | 1      |     | 2             |               |
| Ceramic Dielectric         | U2J    | U2J | Y5S, Y5U, Y5V | Y5S, Y5U, Y5V |
| Voltage (V <sub>AC</sub> ) | 500    | 760 | 500           | 760           |
| Min. Capacitance (pF)      | 10     |     | 33            |               |
| Max. Capacitance (pF)      | 22     |     | 4700          |               |
| Mounting                   | Radial |     |               |               |

#### OPERATING TEMPERATURE RANGE

-40 °C to +125 °C

#### TEMPERATURE CHARACTERISTICS

Class 1: N750 (U2J)

Class 2: Y5S, Y5U, Y5V

#### SECTIONAL SPECIFICATIONS

Climatic category (according to EN 60058-1)

Class 1 and class 2: 40/125/21

#### COATING

According to UL 94 V-0

Epoxy resin, isolating, flame retardant

Halogen-free available

Reinforced insulation

#### APPROVALS

IEC 60384-14.4

UL 60384-14

DIN EN 60384-14

CSA E60384-1:03, CSA E60384-14:09

CQC11-471112-2009

#### PACKAGING

Bulk, tape and reel, taped ammpack

#### FEATURES

- Complying with IEC 60384-14 4<sup>th</sup> edition
- High reliability
- Vertical (inline) kinked or straight leads
- Singlelayer AC disc safety capacitors
- Material categorization:  
for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



#### APPLICATIONS

- X1, Y1 according to IEC 60384-14.4
- Across-the-line
- Line by-pass
- Antenna coupling

#### DESIGN

The capacitor consists of a ceramic disc which is silver plated on both sides. Connection leads are made of tinned copper clad steel having a diameter of 0.6 mm.

The capacitors may be supplied with vertical (inline) kinked leads having a lead spacing of 10.0 mm, or 12.5 mm. Encapsulation is made of flame retardant epoxy resin in accordance with UL 94 V-0.

#### CAPACITANCE RANGE

10 pF to 4700 pF

#### RATED VOLTAGE U<sub>R</sub>

IEC 60384-14.4:

(X1): 760 V<sub>AC</sub>, 50 Hz

(Y1): 500 V<sub>AC</sub>, 50 Hz

1500 V<sub>DC</sub>

#### TEST VOLTAGE

Component test (100 %):

4000 V<sub>AC</sub>, 50 Hz, 2 s

Random sampling test (destructive test):

4000 V<sub>AC</sub>, 50 Hz, 60 s

Voltage proof of coating (destructive test):

4000 V<sub>AC</sub>, 50 Hz, 60 s

#### INSULATION RESISTANCE

≥ 10 000 MΩ

#### CAPACITANCE TOLERANCE

± 20 % (code M); ± 10 % (code K)

#### DISSIPATION FACTOR

Class 1: max. 0.5 % (1 MHz)

Class 2: max. 2.5 % (1 kHz)

**DIMENSIONS** in millimeters


Capacitors with 10.0 mm or 12.5 mm lead spacing

**TECHNICAL DATA**

| CAPACITANCE<br>C (pF)             | CAPACITANCE<br>TOLERANCE<br>(%) | BODY<br>DIAMETER<br>$D_{max.}$ (mm) | BODY<br>THICKNESS<br>$T_{max.}$ (mm) | LEAD SPACING<br>F (mm) $\pm 1$ mm | PART NUMBER                               |
|-----------------------------------|---------------------------------|-------------------------------------|--------------------------------------|-----------------------------------|---|
|                                   |                                 |                                     |                                      |                                   | MISSING DIGITS SEE<br>ORDERING CODE BELOW |
| <b>U2J (N750)</b>                 |                                 |                                     |                                      |                                   |   |
| 10                                | $\pm 10$                        | 8.0                                 | 5.0                                  | 10.0 or 12.5                      | VY1100K31U2JQ6###                         |
| 15                                |                                 |                                     |                                      |                                   | VY1150K31U2JQ6###                         |
| 22                                |                                 |                                     |                                      |                                   | VY1220K31U2JQ6###                         |
| <b>Y5S (2C3)</b>                  |                                 |                                     |                                      |                                   |   |
| 33                                | $\pm 10$                        | 8.0                                 | 5.0                                  | 10.0 or 12.5                      | VY1330K31Y5SQ6###                         |
| 47                                |                                 |                                     |                                      |                                   | VY1470K31Y5SQ6###                         |
| 68                                |                                 |                                     |                                      |                                   | VY1680K31Y5SQ6###                         |
| 100                               |                                 |                                     |                                      |                                   | VY1101K31Y5SQ6###                         |
| 150                               |                                 |                                     |                                      |                                   | VY1151K31Y5SQ6###                         |
| 220                               |                                 |                                     |                                      |                                   | VY1221K31Y5SQ6###                         |
| 330                               |                                 |                                     |                                      |                                   | VY1331K31Y5SQ6###                         |
| <b>Y5U (2E3)</b>                  |                                 |                                     |                                      |                                   |   |
| 470                               | $\pm 20^{(1)}$                  | 8.0                                 | 5.0                                  | 10.0 or 12.5                      | VY1471#31Y5UQ6###                         |
| 680                               |                                 |                                     |                                      |                                   | VY1681#31Y5UQ6###                         |
| 1000                              |                                 | 9.0                                 |                                      |                                   | VY1102#35Y5UQ6###                         |
| 1500                              |                                 | 10.5                                |                                      |                                   | VY1152#41Y5UQ6###                         |
| 2200                              |                                 | 12.0                                |                                      |                                   | VY1222#47Y5UQ6###                         |
| 3300                              |                                 | 15.0                                |                                      |                                   | VY1332#59Y5UQ6###                         |
| 3900                              |                                 | 15.5                                |                                      |                                   | VY1392#61Y5UQ6###                         |
| 4700                              |                                 | 16.0                                |                                      |                                   | VY1472#63Y5UQ6###                         |
| <b>Y5V (2F3) MINI SIZE SERIES</b> |                                 |                                     |                                      |                                   |   |
| 1000                              | $\pm 20$                        | 7.5                                 | 5.5                                  | 10.0 or 12.5                      | VY1102M29Y5VQ6###                         |
| 1500                              |                                 | 8.5                                 |                                      |                                   | VY1152M33Y5VQ6###                         |
| 2200                              |                                 | 9.5                                 |                                      |                                   | VY1222M37Y5VQ6###                         |
| 3300                              |                                 | 11.0                                |                                      |                                   | VY1332M43Y5VQ6###                         |
| 3900                              |                                 | 12.0                                |                                      |                                   | VY1392M47Y5VQ6###                         |
| 4700                              |                                 | 13.0                                |                                      |                                   | VY1472M51Y5VQ6###                         |

**Notes**

- Straight leads available on request
- Coating extension DR valid for straight leads only

 (1)  $\pm 10$  % available on request

| ORDERING CODE  |  |                       |                |                                    |                         |                         |                    |  |                                      |                      |
|----------------|--|-----------------------|----------------|------------------------------------|-------------------------|-------------------------|--------------------|--|--------------------------------------|----------------------|
| #              | 7 <sup>th</sup> digit                      | Capacitance tolerance |                | ± 10 % = K, ± 20 % = M             |                         |                         |                    |  |                                      |                      |
| ###            | 15 <sup>th</sup> to 17 <sup>th</sup> digit | Lead configuration    |                | Available configurations see below |                         |                         |                    |  |                                      |                      |
| <b>Example</b> | <b>VY1</b>                                 | <b>101</b>            | <b>K</b>       | <b>31</b>                          | <b>Y5S</b>              | <b>Q</b>                | <b>6</b>           | <b>T</b>                                     | <b>V</b>                             | <b>0</b>             |
|                | Series                                     | Capacitance value     | Tolerance code | Size code                          | Temperature coefficient | Rated voltage           | Lead wire diameter | Packaging / lead length                      | Lead style                           | Lead spacing         |
|                |  |                       |                |                                    |                         | Q = X1/Y1<br>500 V (AC) |                    | 3 = bulk<br>T = tape and reel<br>U = ammpack | L = straight<br>V = inline<br>kinked | 0 = 10.0<br>X = 12.5 |

| PACKAGING |   |                      |      |      |
|-----------|---|----------------------|------|------|
| SIZE CODE | BODY DIAMETER<br>D <sub>max.</sub> (mm) | PACKAGING QUANTITIES |      |      |
|           |   | BULK                 | REEL | AMMO |
| 31 to 47  | 12.0                                    | 1000                 | 500  | 750  |
| 51 to 63  | 16.0                                    | 500                  | 500  | 750  |

**Note**

- The capacitors are supplied in bulk packaging (cardboard boxes), in tape on reel or in ammpack

**STRAIGHT LEADS**


The sprocket hole pitch ( $P_0$ ) is 12.7 mm for lead spacing 10.0 mm and 12.5 mm

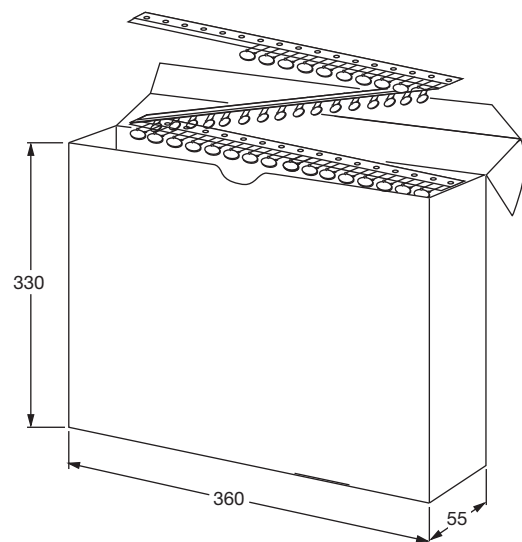
| DIMENSIONS OF TAPE            |  |                          |
|-------------------------------|--|--------------------------|
| SYMBOL                        | PARAMETER                                    | DIMENSIONS (mm)          |
| D <sup>(1)</sup>              | Body diameter                                | 16.0 max.                |
| d                             | Lead diameter                                | 0.6 ± 0.05               |
| P                             | Pitch of component                           | 25.4 ± 1                 |
| P <sub>0</sub> <sup>(2)</sup> | Pitch of sprocket hole                       | 12.7 ± 0.3               |
| P <sub>1</sub> <sup>(3)</sup> | Distance, hole center to lead                | 7.7 or 6.4 ± 1.0         |
| P <sub>2</sub> <sup>(3)</sup> | Distance, hole to center of component        | 12.7 ± 1.5               |
| F                             | Lead spacing                                 | 10.0 or 12.5 + 0.6/- 0.4 |
| Δh                            | Average deviation across tape                | ± 1.0 max.               |
| ΔP                            | Average deviation in direction of reeling    | ± 1.0 max.               |
| W                             | Carrier tape width                           | 18.0 + 1/- 0.5           |
| W <sub>0</sub>                | Hold-down tape width                         | 5.0 min.                 |
| W <sub>1</sub>                | Position of sprocket hole                    | 9.0 + 0.75/- 0.5         |
| W <sub>2</sub>                | Distance of hold-down tape                   | 3.0 max.                 |
| H <sub>1</sub>                | Maximum component height                     | 40.0                     |
| H <sub>0</sub>                | Height to seating plane (for kinked leads)   | 16.0 ± 0.5               |
| H <sub>0</sub>                | Height to seating plane (for straight leads) | 20.0 ± 0.5               |
| L                             | Length of cut leads                          | 11.0 max.                |
| L <sub>1</sub>                | Length of lead protrusion                    | 1.0 max.                 |
| D <sub>0</sub>                | Diameter of sprocket hole                    | 4.0 ± 0.2                |
| t                             | Total tape thickness                         | 0.9 max.                 |
| t <sub>1</sub>                | Total tape thickness with lead wire          | t + d                    |

**Notes**

- (1) See "Technical Data" table  
 (2) Cumulative pitch error: ± 1 mm/20 pitches  
 (3) Obliquity maximum 3°

**REEL AND TAPE DATA** in millimeters


Reel with capacitors on tape



Ammopack with capacitors on tape

**APPROVALS**

IEC 60384-14.4 - Safety tests

This approval together with CB test certificate substitutes all national approvals.

**CB Certificate**

|                                    |             |                 |                     |  |
|------------------------------------|-------------|-----------------|---------------------|--|
| Y1-capacitor: CB test certificate: | US-26561-UL | 10 pF to 4.7 nF | 500 V <sub>AC</sub> |  |
| X1-capacitor: CB test certificate: | US-26561-UL | 10 pF to 4.7 nF | 760 V <sub>AC</sub> |  |

**VDE**

|                                   |          |                 |                     |  |
|-----------------------------------|----------|-----------------|---------------------|--|
| Y1-capacitor: VDE marks approval: | 40012673 | 10 pF to 4.7 nF | 500 V <sub>AC</sub> |  |
| X1-capacitor: VDE marks approval: | 40012673 | 10 pF to 4.7 nF | 760 V <sub>AC</sub> |  |

DIN EN 60384-14 VDE 0565-1-1:2006-04 - Safety tests

**Underwriters Laboratories Inc./Canadian Standards Association**

|                                     |         |                 |                     |  |
|-------------------------------------|---------|-----------------|---------------------|--|
| Y1-capacitor: CSA test certificate: | E183844 | 10 pF to 4.7 nF | 500 V <sub>AC</sub> |  |
| X1-capacitor: CSA test certificate: | E183844 | 10 pF to 4.7 nF | 760 V <sub>AC</sub> |  |

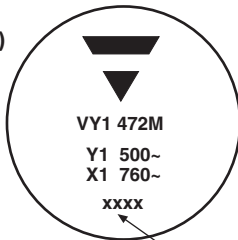
UL 60384-14, CSA E60384-1:03, CSA E60384-14:09

Fixed capacitors for electromagnetic interference suppression and connection to the supply mains.

**CQC**

|                                     |                |                 |                     |  |
|-------------------------------------|----------------|-----------------|---------------------|--|
| Y1-capacitor: CQC test certificate: | CQC05001015032 | 10 pF to 4.7 nF | 500 V <sub>AC</sub> |  |
| X1-capacitor: CQC test certificate: | CQC05001015032 | 10 pF to 4.7 nF | 760 V <sub>AC</sub> |  |

**MARKING**

 Sample  
(2 sides)

 4 digit date code  
(year/week; add suffix "V" for mini size series)


|                       |                    |           |
|-----------------------|--------------------|-----------|
| PN: VY1471M31Y5UQ6XT0 | Lot1: 14Z551S12    | DC1: 0601 |
| QTY: 225              | Lot2:              | DC2:      |
| PO:                   | Batch: 200601CN    |           |
| SO:                   | Region: 9520       | SL: 0010  |
|                       | Ser.No: 0601H69340 |           |



1/1

| <b>PERFORMANCE</b>               |   |   |
|----------------------------------|---|---|
| <b>TEST</b>                      | <b>TEST CONDITION</b>   | <b>TEST LIMITS</b>  |
| Visual and mechanical inspection | Optical inspection, dimensions measured with caliper  | No visible damage, marking legible  |
| Capacitance (C)                  | 25 °C ± 3 °C , relative humidity (RH) ≤ 75 %,<br>1.0 V <sub>RMS</sub> ± 0.2 V <sub>RMS</sub> at 1 kHz for Y5U and Y5S, and 1 MHz for U2J  | Capacitance within specified tolerance  |
| Dissipation factor (DF)          |   | DF ≤ 0.3 % for U2J and<br>DF ≤ 2.5 % for Y5S and Y5U  |
| Insulation resistance (IR)       | Measured within 60 s ± 5 s after charging at 500 V <sub>DC</sub>  | 10 000 MΩ min.  |
| Dielectric strength              | 4000 V <sub>AC</sub> at 50 Hz/60 Hz for 1 min, 50 mA max.   | No failure  |
| Temperature characteristic       | RH ≤ 75 %, 1.0 V <sub>RMS</sub> ± 0.2 V <sub>RMS</sub> at 1 kHz for Y5U and Y5S,<br>and 1 MHz for U2J   | U2J: -750 ppm ± 120 ppm<br>Y5S: ± 22 %<br>Y5U: +22 %/-56 %  |
| Impulse voltage                  | 3 pulses of 8 kV  | No failure  |
| Life test                        | 1000 h at 125 °C ± 2 °C, 850 V <sub>AC</sub> /50 Hz;<br>once every hour 1000 V <sub>AC</sub> for 0.1 s  | External appearance: no visible damage<br>ΔC/C ≤ ± 15 %<br>DF ≤ 0.5 % for U2J and ≤ 5 % for Y5S and Y5U<br>IR ≥ 3000 MΩ<br>Dielectric strength: no failure                                      |
| Humidity test                    | 500 h at 500 V <sub>AC</sub> , 50 Hz and 500 h unloaded<br>40 °C, RH = 90 % to 95%  | External appearance: no visible damage<br>ΔC/C ≤ ± 10 % for U2J and ≤ ± 15 % for Y5S and Y5U<br>DF ≤ 0.5 % for U2J and ≤ 5 % for Y5S and Y5U<br>IR ≥ 3000 MΩ<br>Dielectric strength: no failure |
| Robustness of termination        | Pull test: 0.5 kg tensile weight in radial direction for 10 s ± 1 s<br>Bending strength: capacitor body rotated by 90° in both directions   | No damage to capacitor body and lead wire   |
| Soldering effect                 | Immersion of lead wires into 260 °C ± 5 °C solder for 10 s ± 2 s;<br>min. distance from body: 1.5 mm<br>Hand soldering at 400 °C ± 10 °C for 3 s to 4 s;<br>min. distance from body: 1.5 mm   | External appearance: no visible damage<br>ΔC/C ≤ ± 5 % for U2J and ≤ ± 10 % for Y5S and Y5U<br>Dielectric strength: no failure  |
| Vibration test                   |  <p>Solder the capacitor onto test jig (glass epoxy body) and use resin (adhesive) to stick the body to the test jig.<br/>The capacitor must be soldered firmly to the supporting lead wire.<br/>Vibration change from 10 Hz to 2000 Hz and back to 10 Hz;<br/>Total amplitude: 1.5 mm; Acceleration: 100 m/s<sup>2</sup>;<br/>Sweep rate: 1 oct/min, each axis 2 h (6 h in total)</p> | External appearance: no visible damage<br>Capacitance within specified tolerance<br>DF ≤ 0.3 % for U2J and ≤ 2.5 % for Y5S and Y5U<br>IR ≥ 10 000 GΩ  |

**LEAKAGE CURRENT VS. VOLTAGE** (Typical)

**IMPEDANCE VS. FREQUENCY** (Typical)

**Note**

- The capacitors meet the essential requirements of "EIA 198". Unless stated otherwise all electrical values apply at an ambient temperature of 25 °C ± 3 °C, at normal atmospheric conditions

**RELATED DOCUMENTS**

|                      |  |
|----------------------|--|
| General Information  | <a href="http://www.vishay.com/doc?28536">www.vishay.com/doc?28536</a> |
| CB Test Certificate  | <a href="http://www.vishay.com/doc?22249">www.vishay.com/doc?22249</a> |
| VDE Marks Approval   | <a href="http://www.vishay.com/doc?22251">www.vishay.com/doc?22251</a> |
| UL Test Certificate  | <a href="http://www.vishay.com/doc?22250">www.vishay.com/doc?22250</a> |
| CQC Test Certificate | <a href="http://www.vishay.com/doc?22248">www.vishay.com/doc?22248</a> |
| LTspice® Models      | <a href="http://www.vishay.com/doc?28568">www.vishay.com/doc?28568</a> |

**SAMPLE KITS**

|                                    |  |
|------------------------------------|--|
| Part Number (VY1 Sample Kit)       | VY11-KIT-HF  |
| Link (VY1 Sample Kit)              | <a href="http://www.vishay.com/doc?28552">www.vishay.com/doc?28552</a> |
| Part Number (VY1...Y5V Sample Kit) | VY1-KIT-MS   |
| Link (VY1...Y5V Sample Kit)        | <a href="http://www.vishay.com/doc?28561">www.vishay.com/doc?28561</a> |



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Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А