

## 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 C (pF)	CAPACITANCE TOLERANCE (%)	BODY DIAMETER $D_{max.}$ (mm)	BODY THICKNESS $T_{max.}$ (mm)	LEAD SPACING F (mm) $\pm 1$ mm	PART NUMBER
					MISSING DIGITS SEE 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 500 V (AC)		3 = bulk T = tape and reel U = ammpack	L = straight V = inline kinked	0 = 10.0 X = 12.5

PACKAGING				
SIZE CODE	BODY DIAMETER 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

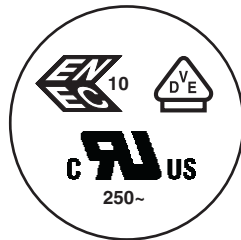
Fixed capacitors for electromagnetic interference suppression and connection to the supply mains.

**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	



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<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 %, 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 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, and 1 MHz for U2J	U2J: -750 ppm ± 120 ppm Y5S: ± 22 % 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; once every hour 1000 V <sub>AC</sub> for 0.1 s	External appearance: no visible damage ΔC/C ≤ ± 15 % DF ≤ 0.5 % for U2J and ≤ 5 % for Y5S and Y5U IR ≥ 3000 MΩ Dielectric strength: no failure
Humidity test	500 h at 500 V <sub>AC</sub> , 50 Hz and 500 h unloaded 40 °C, RH = 90 % to 95%	External appearance: no visible damage ΔC/C ≤ ± 10 % for U2J and ≤ ± 15 % for Y5S and Y5U DF ≤ 0.5 % for U2J and ≤ 5 % for Y5S and Y5U IR ≥ 3000 MΩ Dielectric strength: no failure
Robustness of termination	Pull test: 0.5 kg tensile weight in radial direction for 10 s ± 1 s 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; min. distance from body: 1.5 mm Hand soldering at 400 °C ± 10 °C for 3 s to 4 s; min. distance from body: 1.5 mm	External appearance: no visible damage ΔC/C ≤ ± 5 % for U2J and ≤ ± 10 % for Y5S and Y5U 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. The capacitor must be soldered firmly to the supporting lead wire. Vibration change from 10 Hz to 2000 Hz and back to 10 Hz; Total amplitude: 1.5 mm; Acceleration: 100 m/s<sup>2</sup>; Sweep rate: 1 oct/min, each axis 2 h (6 h in total)</p>	External appearance: no visible damage Capacitance within specified tolerance DF ≤ 0.3 % for U2J and ≤ 2.5 % for Y5S and Y5U 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  $25\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$ , 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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