

### Vishay BCcomponents

### **AC Line Rated Ceramic Disc Capacitors** Class X1, 760 V<sub>AC</sub>, Class Y1, 500 V<sub>AC</sub>



### **FEATURES**

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

# RoHS

GREEN

### HALOGEN **FREE**

### **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 UP

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**

 $\geq$  10 000 M $\Omega$ 

### **CAPACITANCE TOLERANCE**

± 20 % (code M); ± 10 % (code K)

#### **DISSIPATION FACTOR**

Class 1: max. 0.5 % (1 MHz) Class 2: max. 2.5 % (1 kHz)

### **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)	1	0	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**

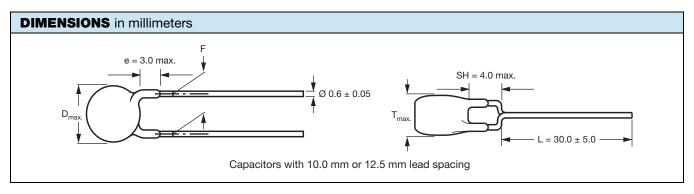
IEC 60384-14.4 UL 60384-14 DIN EN 60384-14 CSA E60384-1:03, CSA E60384-14:09 CQC11-471112-2009

### **PACKAGING**

Bulk, tape and reel, taped ammopack



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TECHNICAL DATA					
CAPACITANCE	CAPACITANCE	BODY	BODY BODY		PART NUMBER
C (pF)	TOLERANCE (%)	DIAMETER D <sub>max.</sub> (mm)	THICKNESS T <sub>max.</sub> (mm)	LEAD SPACING F (mm) ± 1 mm	MISSING DIGITS SEE ORDERING CODE BELOW
U2J (N750)					
10					VY1100K31U2JQ6###
15	± 10	8.0	5.0	10.0 or 12.5	VY1150K31U2JQ6###
22					VY1220K31U2JQ6###
Y5S (2C3)					
33					VY1330K31Y5SQ6###
47					VY1470K31Y5SQ6###
68					VY1680K31Y5SQ6###
100	± 10	8.0	5.0	10.0 or 12.5	VY1101K31Y5SQ6###
150					VY1151K31Y5SQ6###
220					VY1221K31Y5SQ6###
330					VY1331K31Y5SQ6###
Y5U (2E3)					
470		8.0		10.0 or 12.5	VY1471#31Y5UQ6###
680		6.0			VY1681#31Y5UQ6###
1000		9.0	]		VY1102#35Y5UQ6###
1500	± 20 <sup>(1)</sup>	10.5			VY1152#41Y5UQ6###
2200	± 20 (1)	12.0	5.0		VY1222#47Y5UQ6###
3300		15.0	]		VY1332#59Y5UQ6###
3900		15.5			VY1392#61Y5UQ6###
4700		16.0			VY1472#63Y5UQ6###
Y5V (2F3) MINI SIZ	E SERIES				
1000		7.5			VY1102M29Y5VQ6###
1500		8.5			VY1152M33Y5VQ6###
2200	1	9.5	E E	10.0 0 10.5	VY1222M37Y5VQ6###
3300	± 20	11.0	5.5	10.0 or 12.5	VY1332M43Y5VQ6###
3900		12.0	1		VY1392M47Y5VQ6###
4700		13.0		j F	VY1472M51Y5VQ6###

### Notes

- Straight leads available on request
- · Coating extension DR valid for straight leads only
- $^{(1)}$  ± 10 % available on request



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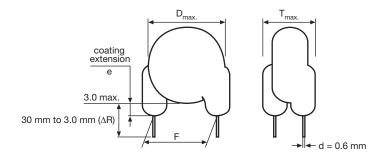
ORDERING CODE										
#	7 <sup>th</sup> digit		Capacitar	ce tolerance	Э	± 10 % =	K, ± 20 % =	: M		
###	15 <sup>th</sup> to 17	7 <sup>th</sup> digit	Lead conf	guration		Available	configuratio	ns see below		
Example	VY1	101	K	31	Y5S	Q	6	Т	٧	0
	Series	Capacitance value	Tolerance code	Size code	Temperature 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 = ammopack	L = straight V = inline kinked	0 = 10.0 X = 12.5

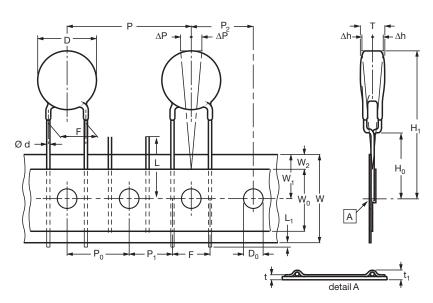
PACKAGING				
SIZE CODE	BODY DIAMETER		PACKAGING QUANTITIES	
SIZE CODE	D <sub>max.</sub> (mm)	BULK	REEL	AMMO
31 to 47	12.0	1000	500	750
51 to 63	16.0	500	500	750

#### Note

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

### STRAIGHT LEADS





The sprocket hole pitch (P<sub>0</sub>) is 12.7 mm for lead spacing 10.0 mm and 12.5 mm



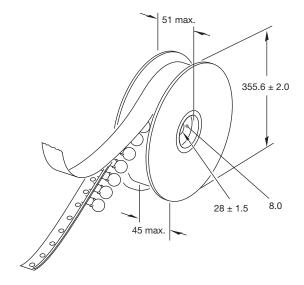
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DIMENSIONS	DIMENSIONS OF TAPE				
SYMBOL	PARAMETER	DIMENSIONS (mm)			
D (1)	Body diameter	16.0 max.			
d	Lead diameter	$0.6 \pm 0.05$			
Р	Pitch of component	25.4 ± 1			
P <sub>0</sub> (2)	Pitch of sprocket hole	12.7 ± 0.3			
P <sub>1</sub> <sup>(3)</sup>	Distance, hole center to lead	7.7 or 6.4 ± 1.0			
P <sub>2</sub> (3)	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.			
ΔΡ	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			

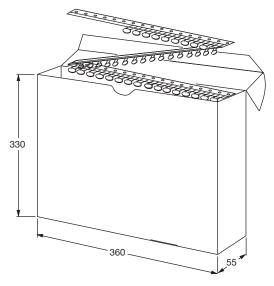
#### Notes

- (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



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### **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  $V_{AC}$  X1-capacitor: CB test certificate: US-26561-UL 10 pF to 4.7 nF 760  $V_{AC}$ 



**VDE** 

Y1-capacitor: VDE marks approval: 40012673 10 pF to 4.7 nF 500  $V_{AC}$  X1-capacitor: VDE marks approval: 40012673 10 pF to 4.7 nF 760  $V_{AC}$ 



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  $V_{AC}$  X1-capacitor: CSA test certificate: E183844 10 pF to 4.7 nF 760  $V_{AC}$ 



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

VY1 472M

Y1 500~ X1 760~

XXXX

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

#### CQC

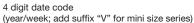
Y1-capacitor: CQC test certificate: CQC05001015032 10 pF to 4.7 nF 500  $V_{AC}$  X1-capacitor: CQC test certificate: CQC05001015032 10 pF to 4.7 nF 760  $V_{AC}$ 



### **MARKING**













QTY: 225 PO: SO:

PN: VY1471M31Y5UQ6XT0

Batch: 200601CN Region: 9520 Ser.No: 0601H69340

Lot2:

SL: 0010



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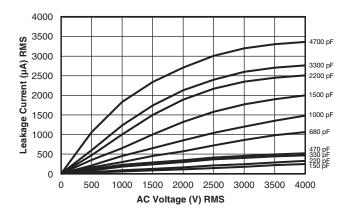


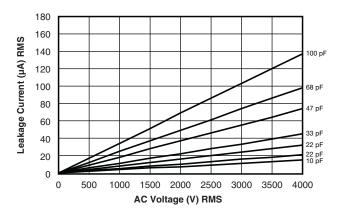
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PERFORM	PERFORMANCE				
TEST	TEST CONDITION	TEST LIMITS			
Visual and mechanical inspection	Optical inspection, dimensions measured with caliper	No visible damage, marking legible			
Capacitance (C) Dissipation factor (DF)	$25~^\circ\text{C}\pm3~^\circ\text{C}$ , relative humidity (RH) $\leq 75~\%,$ $1.0~V_{RMS}\pm0.2~V_{RMS}$ at 1 kHz for Y5U and Y5S, and 1 MHz for U2J	Capacitance within specified tolerance  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 M $\Omega$ min.			
Dielectric strength	4000 V <sub>AC</sub> at 50 Hz/60 Hz for 1 min, 50 mA max.	No failure			
Temperature characteristic	RH $\leq 75$ %, 1.0 $V_{RMS}$ ± 0.2 $V_{RMS}$ 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 $\pm$ 2 °C, 850 $V_{AC}$ /50 Hz; once every hour 1000 $V_{AC}$ for 0.1 s	External appearance: no visible damage $\Delta C/C \le \pm 15~\%$ DF $\le 0.5~\%$ for U2J and $\le 5~\%$ for Y5S and Y5U IR $\ge 3000~\text{M}\Omega$ Dielectric strength: no failure			
Humidity test	500 h at 500 $V_{AC}$ , 50 Hz and 500 h unloaded 40 °C, RH = 90 % to 95%	External appearance: no visible damage $\Delta C/C \le \pm 10$ % for U2J and $\le \pm 15$ % for Y5S and Y50 DF $\le 0.5$ % for U2J and $\le 5$ % for Y5S and Y5U IR $\ge 3000$ M $\Omega$ Dielectric strength: no failure			
Robustness of termination	Pull test: 0.5 kg tensile weight in radial direction for 10 s $\pm$ 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 $\pm$ 5 °C solder for 10 s $\pm$ 2 s; min. distance from body: 1.5 mm Hand soldering at 400 °C $\pm$ 10 °C for 3 s to 4 s; min. distance from body: 1.5 mm	External appearance: no visible damage $\Delta C/C \le \pm 5$ % for U2J and $\le \pm 10$ % for Y5S and Y5I Dielectric strength: no failure			
Vibration test	Resin (adhesive)  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/s²;  Sweep rate: 1 oct/min, each axis 2 h (6 h in total)	External appearance: no visible damage Capacitance within specified tolerance DF $\leq$ 0.3 % for U2J and $\leq$ 2.5 % for Y5S and Y5U IR $\geq$ 10 000 $G\Omega$			

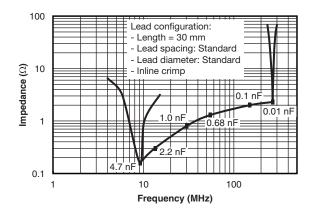


### **LEAKAGE CURRENT VS. VOLTAGE (Typical)**





### **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	www.vishay.com/doc?28536			
CB Test Certificate	www.vishay.com/doc?22249			
VDE Marks Approval	www.vishay.com/doc?22251			
UL Test Certificate	www.vishay.com/doc?22250			
CQC Test Certificate	www.vishay.com/doc?22248			
LTspice® Models	www.vishay.com/doc?28568			

SAMPLE KITS	
Part Number (VY1 Sample Kit)	VY11-KIT-HF
Link (VY1 Sample Kit)	www.vishay.com/doc?28552
Part Number (VY1Y5V Sample Kit)	VY1-KIT-MS
Link (VY1Y5V Sample Kit)	www.vishay.com/doc?28561



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