EMI Suppression Safety Capacitor, Ceramic Disc, Class X1, 760 V_{AC}, Class Y1, 500 V_{AC}



FEATURES

- Complying with IEC 60384-14
- Can pass 10 kV pulses (10 per polarity)
- Withstands 1000 h at 85 °C / 85 % RH with rated voltage applied, approved by VDE Annex I grade IIIB
- Reduced size (compact design)
- 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

Pb e3 RoHS COMPLIANT HALOGEN FREE GREEN (5-2008)

LINKS TO ADDITIONAL RESOURCES

3D Models SPICE Models

QUICK REFERENCE DATA		
DESCRIPTION	VALUE	
Ceramic Class	2	
Ceramic Dielectric	Y5U	Y5U
Voltage (V_{AC})	500	760
Min. Capacitance (pF)	470	
Max. Capacitance (pF)	4700	
Mounting	Radial	

OPERATING TEMPERATURE RANGE

-40 °C to +125 °C

TEMPERATURE CHARACTERISTICS

Y5U

SECTIONAL SPECIFICATIONS

Climatic category (according to EN 60058-1)
40/125/21

COATING

According to UL 94 V-0
Epoxy resin, isolating, flame retardant
Halogen-free
Reinforced insulation

APPROVALS

IEC 60384-14
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

APPLICATIONS

- X1, Y1 according to IEC 60384-14
- Line-to-line filtering (Class X)
- Line-to-ground filtering (Class Y)
- Primary and secondary coupling (SMPS)
- EMI / RFI suppression and filtering

DESIGN

The capacitor consists of a ceramic disc which is copper 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

470 pF to 4700 pF

RATED VOLTAGE U_R

IEC 60384-14:
(X1): 760 V_{AC}, 50 Hz
(Y1): 500 V_{AC}, 50 Hz
1500 V_{DC}

TEST VOLTAGE

Component test (100 %):
4000 V_{AC}, 50 Hz, 2 s
Random sampling test (destructive test):
4000 V_{AC}, 50 Hz, 60 s
Voltage proof of coating (destructive test):
4000 V_{AC}, 50 Hz, 60 s

INSULATION RESISTANCE

≥ 10 000 MΩ

CAPACITANCE TOLERANCE

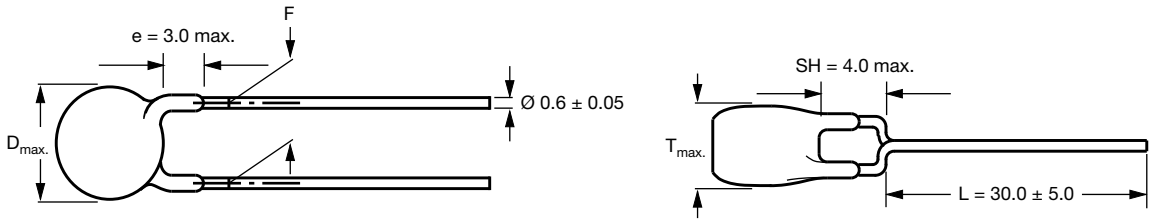
± 20 %

DISSIPATION FACTOR

Max. 2.5 % (1 kHz)

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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) ± 1 mm	PART NUMBER MISSING DIGITS SEE ORDERING CODE BELOW
470	± 20	7.5	5.0	10.0 or 12.5	VY1471M29Y5UC6###
680					VY1681M29Y5UC6###
1000		8.0			VY1102M31Y5UC6###
1500		9.0			VY1152M35Y5UC6###
2200		11.0			VY1222M43Y5UC6###
2700		12.0			VY1272M47Y5UC6###
3300		13.0			VY1332M51Y5UC6###
3900		15.0			VY1392M59Y5UC6###
4700		15.5			VY1472M61Y5UC6###

Notes

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

ORDERING CODE

#	7th digit		Capacitance tolerance		± 20 % = M					
###	15th to 17th digit		Lead configuration		Available configurations see below					
Example	**VY1**	**471**	**M**	**29**	**Y5U**	**C**	**6**	**T**	**V**	**0**
	Series	Capacitance value	Tolerance code	Size code	Temperature coefficient	Rated voltage Compact size	Lead wire diameter	Packaging / lead length 3 = bulk T = tape and reel U = ammopack	Lead style L = straight V = inline kinked	Lead spacing 0 = 10.0 X = 12.5

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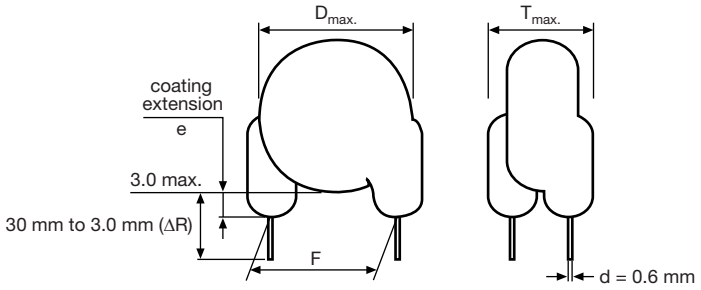
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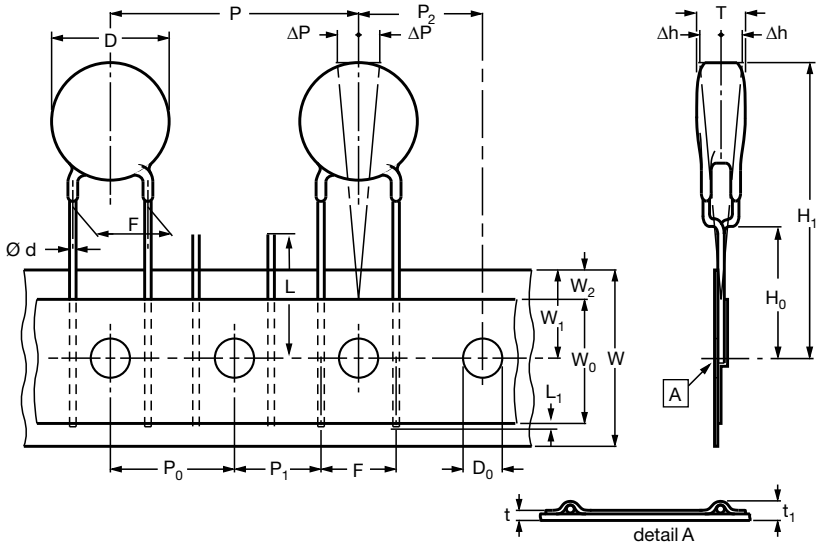
PACKAGING					
CAPACITANCE VALUE	SIZE CODE	BODY DIAMETER $D_{max.}$ (mm)	PACKAGING QUANTITIES		
			BULK	REEL	AMMO
470 pF to 2700 pF	29 to 47	12.0	1000	500	750
3300 pF to 4700 pF	51 to 61	15.5	500	500	750

Note

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

STRAIGHT LEADS





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

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DIMENSIONS OF TAPE		
SYMBOL	**PARAMETER**	**DIMENSIONS (mm)**
D (1)	Body diameter	16.0 max.
d	Lead diameter	0.6 ± 0.05
P	Pitch of component	25.4 ± 1
P_0 (2)	Pitch of sprocket hole	12.7 ± 0.3
P_1 (3)	Distance, hole center to lead	7.7 or 6.4 ± 1.0
P_2 (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.
ΔP	Average deviation in direction of reeling	± 1.0 max.
W	Carrier tape width	18.0 + 1/- 0.5
W_0	Hold-down tape width	5.0 min.
W_1	Position of sprocket hole	9.0 + 0.75/- 0.5
W_2	Distance of hold-down tape	3.0 max.
H_1	Maximum component height	40.0
H_0	Height to seating plane (for kinked leads)	16.0 ± 0.5
H_0	Height to seating plane (for straight leads)	20.0 ± 0.5
L	Length of cut leads	11.0 max.
L_1	Length of lead protrusion	1.0 max.
D_0	Diameter of sprocket hole	4.0 ± 0.2
t	Total tape thickness	0.9 max.
t_1	Total tape thickness with lead wire	t + d

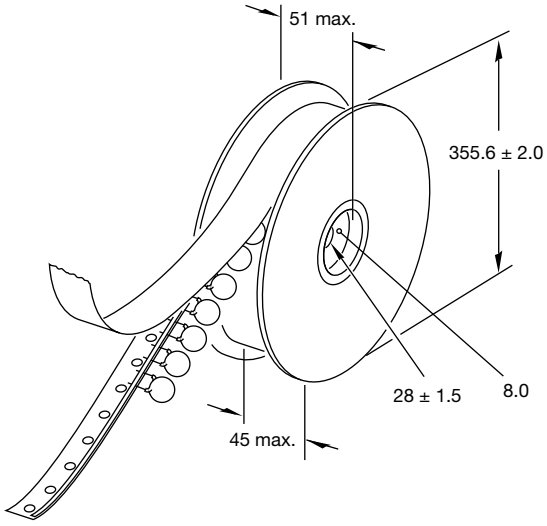
Notes

(1) See “Technical Data” table

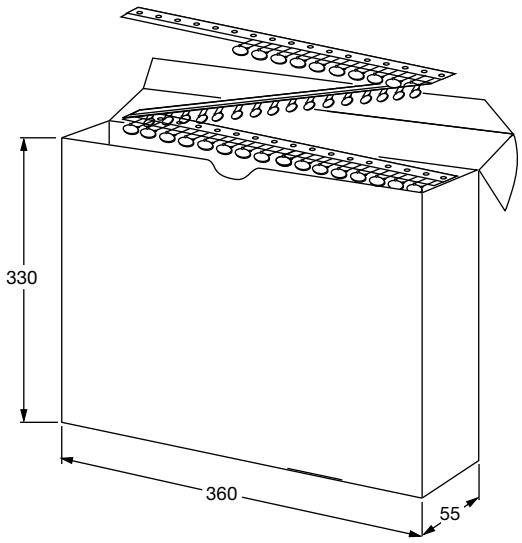
(2) Cumulative pitch error: ± 1 mm/20 pitches

(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 - Safety tests
This approval together with CB test certificate substitutes all national approvals.

CB Certificate

Y1-capacitor: CB test certificate:	US-26561-UL	470 pF to 4.7 nF	500 V_{AC}	
X1-capacitor: CB test certificate:	US-26561-UL	470 pF to 4.7 nF	760 V_{AC}	

VDE

Y1-capacitor: VDE marks approval:	40012673	470 pF to 4.7 nF	500 V_{AC}	
X1-capacitor: VDE marks approval:	40012673	470 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	470 pF to 4.7 nF	500 V_{AC}	
X1-capacitor: CSA test certificate:	E183844	470 pF to 4.7 nF	760 V_{AC}	

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

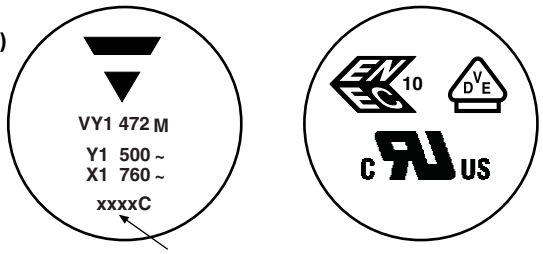
Fixed capacitors for electromagnetic interference suppression and connection to the supply mains.

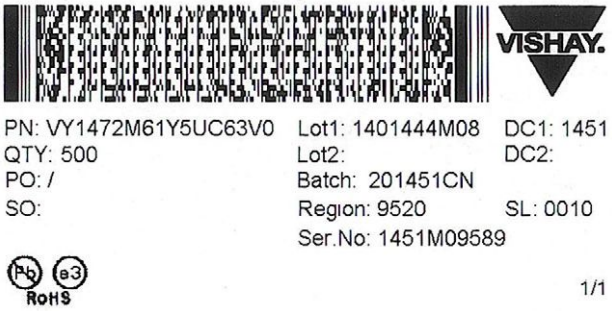
CQC

Y1-capacitor: CQC test certificate:	CQC05001015032	470 pF to 4.7 nF	500 V_{AC}	
X1-capacitor: CQC test certificate:	CQC05001015032	470 pF to 4.7 nF	760 V_{AC}	

MARKING

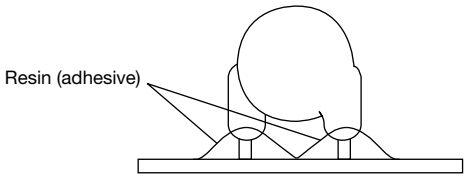
Sample (2 sides)





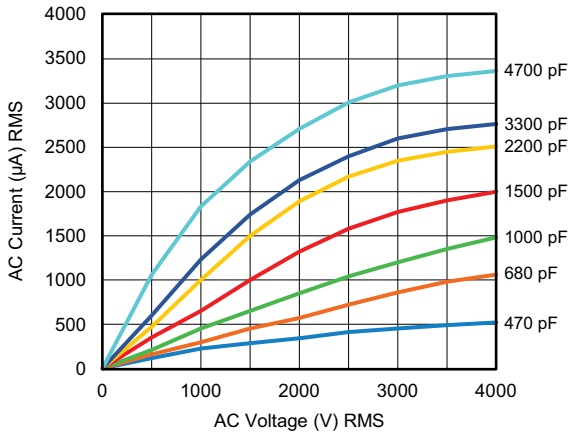
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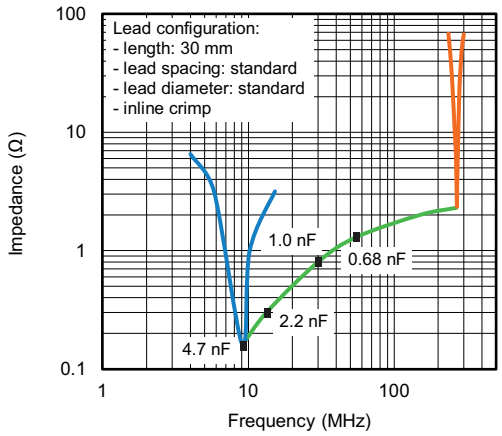
PERFORMANCE		
TEST	**TEST CONDITION**	**TEST LIMITS**
Visual and mechanical inspection	Optical inspection, dimensions measured with caliper	No visible damage, marking legible
Capacitance (C)	25 °C ± 3 °C , relative humidity (RH) ≤ 75 %, 1.0 V_{RMS} ± 0.2 V_{RMS} at 1 kHz	Capacitance within specified tolerance
Dissipation factor (DF)		DF ≤ 2.5 %
Insulation resistance (IR)	Measured within 60 s ± 5 s after charging at 500 V_{DC}	10 000 MΩ min.
Dielectric strength	4000 V_{AC} at 50 Hz/60 Hz for 1 min, 50 mA max.	No failure
Temperature characteristic	RH ≤ 75 %, 1.0 V_{RMS} ± 0.2 V_{RMS} at 1 kHz	+22 % / -56 %
Impulse voltage	Pulse voltage: 10 kV Pulses per polarity: 10 Polarity: ± (both) Time between pulses of same polarity: 20 s Time between pulses of different polarity: 30 s	No failure
Life test	1000 h at 125 °C ± 2 °C, 850 V_{AC} / 50 Hz; once every hour 1000 V_{AC} for 0.1 s	External appearance: no visible damage ΔC/C ≤ ± 15 % DF ≤ 5 % IR ≥ 3000 MΩ Dielectric strength: no failure
Damp heat test (85 / 85 / 1000 h)	1000 h + 48 h / - 0 h at 85 % relative humidity, 85 °C ± 3 °C, loading voltage: 760 V_{AC}	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 ΔC/C ≤ ± 15 % DF ≤ 5 % 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 ≤ ± 10 % Dielectric strength: no failure
Vibration test	 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^2; Sweep rate: 1 oct/min, each axis 2 h (6 h in total)	External appearance: no visible damage Capacitance within specified tolerance DF ≤ 2.5 % IR ≥ 10 000 GΩ

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AC 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 KIT	
Part Number	VY11-KIT-CS
Link	www.vishay.com/doc?28556

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