EMI Suppression Safety Capacitor, Ceramic Disc, Class X1, 440 V_{AC}, Class Y2, 300 V_{AC}

FEATURES

- Complying with IEC 60384-14
- 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)

APPLICATIONS

- X1, Y2 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

LINKS TO ADDITIONAL RESOURCES

3D Models SPICE Models

QUICK REFERENCE DATA				
DESCRIPTION	VALUE			
Ceramic Class	1		2	
Ceramic Dielectric	U2J		Y5S, Y5U, Y5V	
Voltage (V_{AC})	300	440	300	440
Min. Capacitance (pF)	10		68	
Max. Capacitance (pF)	47		10 000	
Mounting	Radial			

OPERATING TEMPERATURE RANGE

-40 °C to +125 °C

TEMPERATURE CHARACTERISTICS

Class 1: 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

APPROVALS

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

PACKAGING

Bulk, tape and reel, taped ammopack

DESIGN

The capacitor consists of a ceramic disc which is silver plated on both sides. Connection leads are made of tin plated 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 5.0 mm, 7.5 mm, 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 0.01 µF

RATED VOLTAGE U_R

IEC 60384-14:
(X1): 440 V_{AC}, 50 Hz
(Y2): 300 V_{AC}, 50 Hz
1000 V_{DC}

TEST VOLTAGE

Component test (100 %):
2600 V_{AC}, 50 Hz, 2 s
(2600 V_{AC} for LS 7.5 mm and above)
(2200 V_{AC} for LS 5.0 mm)
Random sampling test (destructive test):
2600 V_{AC}, 50 Hz, 60 s
Voltage proof of coating (destructive test):
2600 V_{AC}, 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)

For technical questions, contact: cdc@vishay.com

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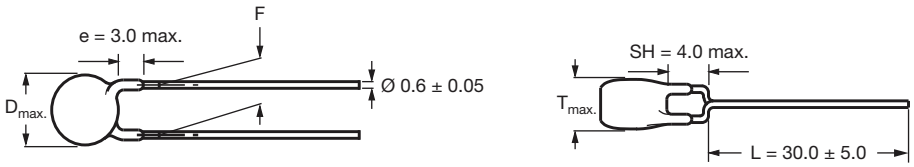
DIMENSIONS in millimeters



Capacitors with 5.0 mm, 7.5 mm, 10 mm, or 12.5 mm lead spacing.
Coating extension e valid for straight leads only.

TECHNICAL DATA

CAPACITANCE C (pF)	CAPACITANCE TOLERANCE (%)	BODY DIAMETER $D_{max.}$ (mm)	BODY THICKNESS $T_{max.}$ (mm)	LEAD SPACING [1] F (mm) ± 1 mm	PART NUMBER MISSING DIGITS SEE ORDERING CODE BELOW
U2J					
10	± 10	7.5	5.0	5.0, 7.5, 10.0, or 12.5	VY2100K29U2JS6###
15					VY2150K29U2JS6###
22					VY2220K29U2JS6###
33					VY2330K29U2JS6###
47					VY2470K29U2JS6###
Y5S					
68	± 10	7.5	5.0	5.0, 7.5, 10.0, or 12.5	VY2680K29Y5SS6###
100					VY2101K29Y5SS6###
150					VY2151K29Y5SS6###
220					VY2221K29Y5SS6###
330					VY2331K29Y5SS6###
470					VY2471K29Y5SS6###
Y5U					
680	± 20	7.5	5.0	5.0, 7.5, 10.0, or 12.5	VY2681M29Y5US6###
1000					VY2102M29Y5US6###
1500		8.0			VY2152M31Y5US6###
2200		9.0			VY2222M35Y5US6###
3300		10.5			VY2332M41Y5US6###
3900		11.0			VY2392M43Y5US6###
4700		12.5		7.5, 10.0, or 12.5	VY2472M49Y5US6###
6800		14.5			VY2682M59Y5US63##
10 000		16.0			VY2103M63Y5US63##
Y5V MINI SIZE SERIES					
1000	± 20	7.5	5.0	5.0, 7.5, 10.0, or 12.5	VY2102M29Y5VS6###
1500		7.5			VY2152M29Y5VS6###
2200		8.0			VY2222M31Y5VS6###
3300		9.0			VY2332M35Y5VS6###
3900		10.0			VY2392M39Y5VS6###
4700		10.5			VY2472M41Y5VS6###
6800		12.0			VY2682M47Y5VS6###
10 000		15.0			VY2103M59Y5VS6###

Note

[1] Straight leads are available on request

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ORDERING CODE

###	15th to 17th digit		Lead configuration			Available configurations see below				
Example	**VY2**	**221**	**K**	**29**	**Y5S**	**S**	**6**	**U**	**V**	**7**
	Series	Capacitance value	Tolerance code	Size code	Temperature coefficient	Rated voltage	Lead wire diameter	Packaging / lead length	Lead style	Lead spacing
						S = X1/Y2 300 V (AC)		3 = bulk T = tape and reel U = ammopack	L = straight V = inline kinked	5 = 5.0 7 = 7.5 0 = 10.0 X = 12.5

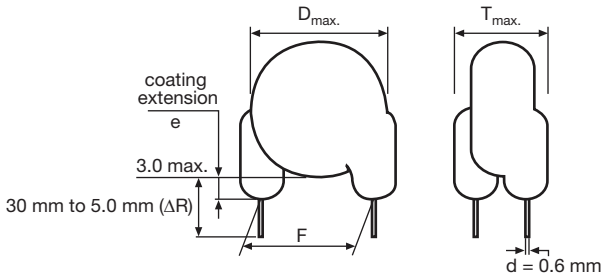
PACKAGING

LEAD SPACING (mm)	CAPACITANCE VALUE	BODY DIAMETER $D_{max.}$ (mm)	PACKAGING QUANTITIES			TAPING FIGURE
			BULK	REEL	AMMO	
5.0	10 pF to 4700 pF	11.0	1000	1000	1000	Fig. 1
7.5	10 pF to 6800 pF	14.0	1000	1000	1000	Fig. 1
	6800 pF to 10 000 pF	16.0	500	500	500	Fig. 2
10.0 / 12.5	10 pF to 6800 pF	14.0	1000	500	750	Fig. 2
	6800 pF to 10 000 pF	16.0	500	500	750	Fig. 2

Note

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

STRAIGHT LEADS



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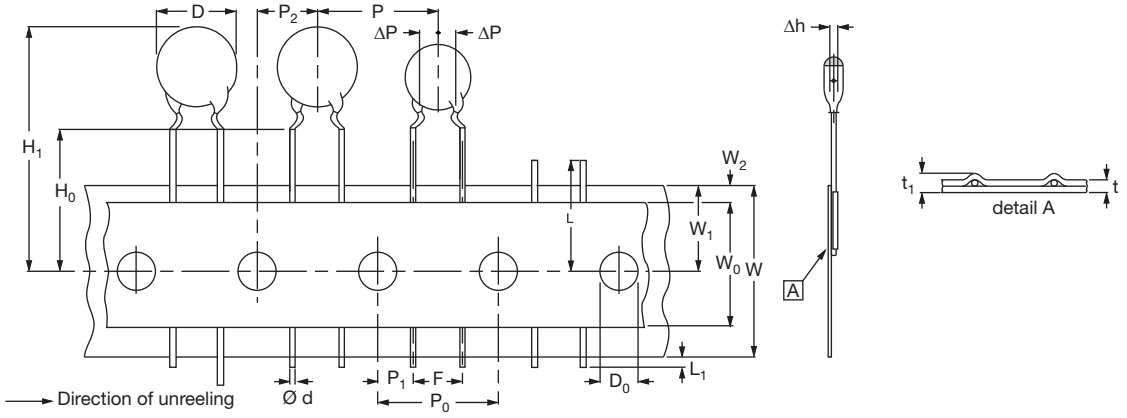

Fig. 1 - The hole pitch 12.7 mm for lead spacing 5 mm (0.2") and 15.0 mm for lead spacing 7.5 mm (0.3")

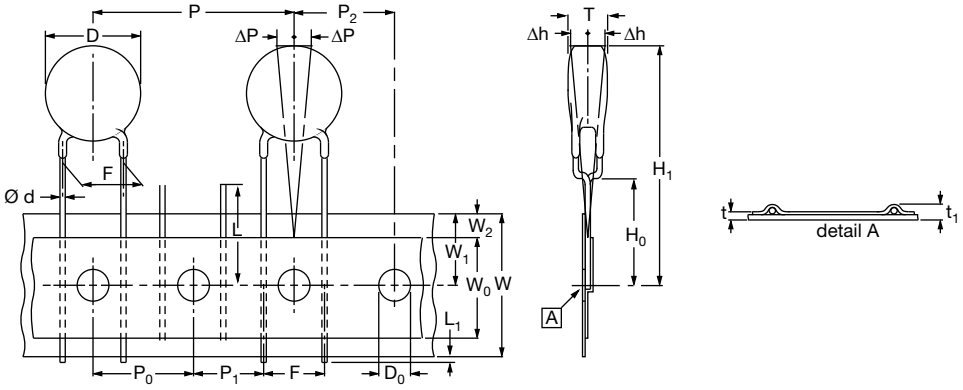

Fig. 2 - The hole pitch 12.7 mm for lead spacing 10.0 mm (0.40") and 12.5 mm (0.50")

DIMENSION OF TAPE				
SYMBOL	PARAMETER	DIMENSIONS (mm)		
		FIG. 1 (5 mm)	FIG. 1 (7.5 mm)	FIG. 2 (10 mm)
D (1)	Body diameter	11.0 max.	14.0 max.	16.0 max.
d	Lead diameter	0.6 ± 0.05	0.6 ± 0.05	0.6 ± 0.05
P	Pitch of component	12.7 ± 1	15.0 ± 1	25.4 ± 1
P_0 (2)	Pitch of sprocket hole	12.7 ± 0.3	15.0 ± 0.3	12.7 ± 0.3
P_1 (3)	Distance, hole center to lead	3.85 ± 0.7	3.75 ± 0.7	7.7 ± 1.0
P_2 (3)	Distance, hole to center of component	6.35 ± 1.3	7.5 ± 1.5	12.7 ± 1.5
F	Lead spacing	5.0 (+ 0.6 / - 0.4)	7.5 (+ 0.6 / - 0.4)	10.0 (+ 0.6 / - 0.4)
Δh	Average deviation across tape	± 1.0 max.	± 1.0 max.	± 1.0 max.
ΔP	Average deviation in direction of reeling	± 1.0 max.	± 1.0 max.	± 1.0 max.
W	Carrier tape width	18.0 + 1 / - 0.5	18.0 + 1/- 0.5	18.0 + 1 / - 0.5
W_0	Hold-down tape width	5.0 min.	5.0 min.	5.0 min.
W_1	Position of sprocket hole	9.0 + 0.75 / - 0.5	9.0 + 0.75 / - 0.5	9.0 + 0.75 / - 0.5
W_2	Distance of hold-down tape	3.0 max.	3.0 max.	3.0 max.
H_1	Maximum component height	32	40	40
H_0	Height to seating plane (for kinked leads)	16.0 ± 0.5	16.0 ± 0.5	16.0 ± 0.5
H_0	Height to seating plane (for straight leads)	20.0 ± 0.5	20.0 ± 0.5	20.0 ± 0.5
L	Length of cut leads	11.0 max.	11.0 max.	11.0 max.
L_1	Length of lead protrusion	1.0 max.	1.0 max.	1.0 max.
D_0	Diameter of sprocket hole	4.0 ± 0.2	4.0 ± 0.2	4.0 ± 0.2
t	Total tape thickness	0.9 max.	0.9 max.	0.9 max.
t_1	Maximum thickness of tape and wires	1.5 max.	1.5 max.	1.5 max.

Notes

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

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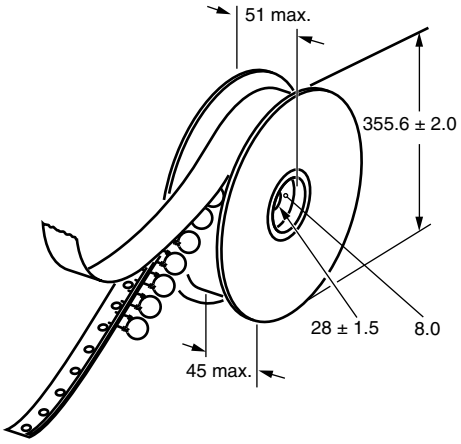
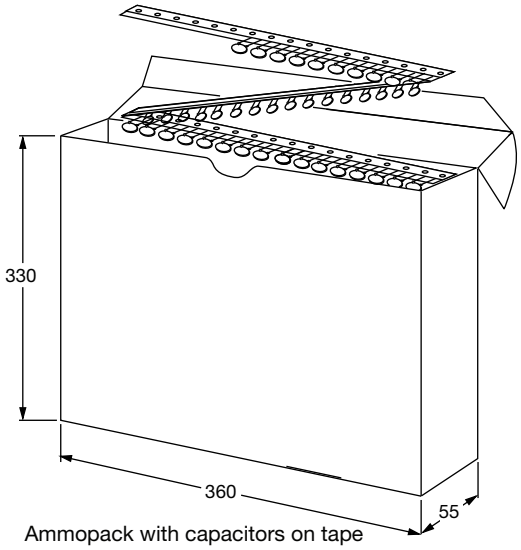
REEL AND TAPE DATA in millimeters





Ammopack with capacitors on tape

APPROVALS

IEC 60384-14 - Safety tests
This approval together with CB test certificate substitutes all national approvals.

CB Certificate

Y2-capacitor: CB test certificate:	US-26163-UL	10 pF to 10 nF	300 V_{AC}
X1-capacitor: CB test certificate:	US-26163-UL	10 pF to 10 nF	440 V_{AC}

VDE

Y2-capacitor: VDE marks approval:	40009669	10 pF to 10 nF	300 V_{AC}
X1-capacitor: VDE marks approval:	40009669	10 pF to 10 nF	440 V_{AC}

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

Underwriters Laboratories Inc. / Canadian Standards Association

Y2-capacitor: UL-test certificate:	E183844	10 pF to 10 nF	300 V_{AC}
X1-capacitor: UL-test certificate:	E183844	10 pF to 10 nF	440 V_{AC}

UL 60384-14.1, CSA E60384-1:03 2nd edition, CSA E60384-14:09 2nd edition

Across-the-line, antenna-coupling, and line-by-pass component

CQC

Y2-capacitor: CQC test certificate:	CQC05001012316	10 pF to 10 nF	300 V_{AC}
X1-capacitor: CQC test certificate:	CQC05001012316	10 pF to 10 nF	440 V_{AC}

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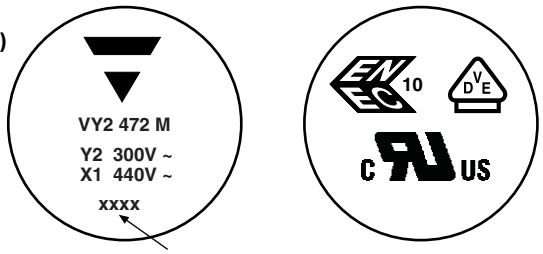
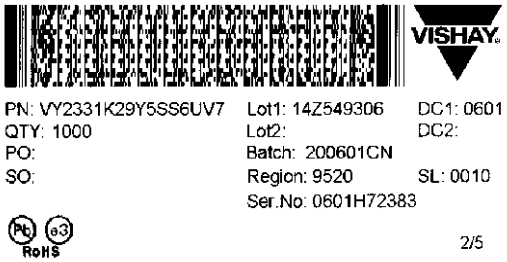
MARKING

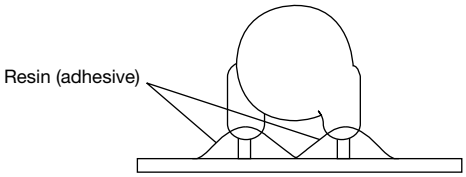
Sample (2 sides)



Front Back



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 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_{DC}	10 000 MΩ min.
Dielectric strength	2600 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 for Y5U and Y5S, and 1 MHz for U2J	U2J: -750 ppm ± 120 ppm Y5S: ± 22 % Y5U: +22 % / -56 %
Impulse voltage	3 pulses of 5 kV	No failure
Life test	1000 h at 125 °C ± 2 °C, 550 V_{AC}/50 Hz; once every hour 1000 V_{AC} 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 440 V_{AC}, 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	 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 ≤ 0.3 % for U2J and ≤ 2.5 % for Y5S and Y5U IR ≥ 10 000 GΩ

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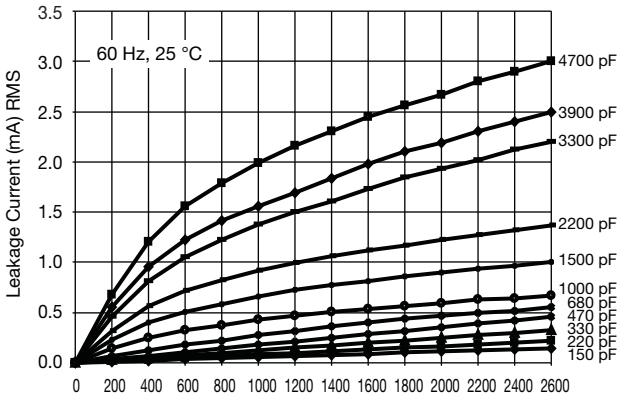
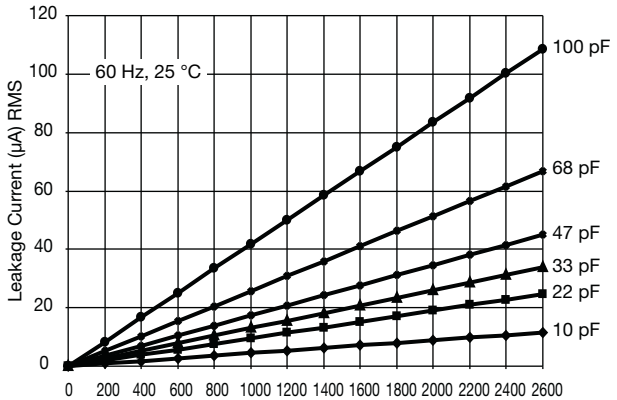
LEAKAGE CURRENT VS. VOLTAGE (Typical)





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?22254
VDE Marks Approval	www.vishay.com/doc?22256
UL Test Certificate	www.vishay.com/doc?22253
CQC Test Certificate	www.vishay.com/doc?22255
LTspice® Models	www.vishay.com/doc?28568

SAMPLE KITS	
Part Number (VY2 Sample Kit)	VY21-KIT-HF
Link (VY2 Sample Kit)	www.vishay.com/doc?28554
Part Number (VY2...Y5V Sample Kit)	VY2-KIT-MS
Link (VY2...Y5V Sample Kit)	www.vishay.com/doc?28562

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EMI SAFETY CAPACITOR SOLUTIONS

FILM AND CERAMIC

CLASS X

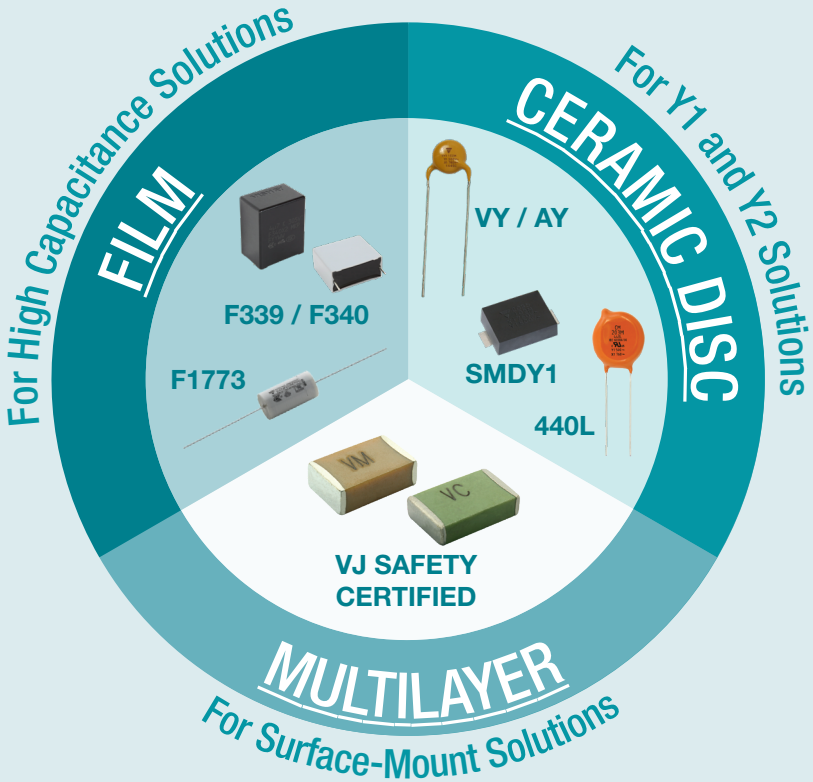
Differential Mode Filtering
Across the Line

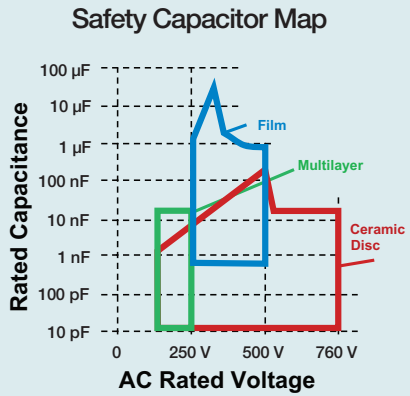
Sub class	Peak Impulse Voltage	Typical Application
X1	4.0 kV	High Pulse
X2	2.5 kV	General Purpose

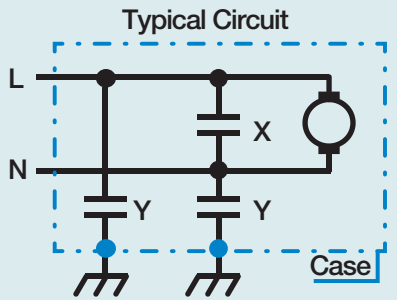
CLASS Y

Common Mode Filtering
Line to Ground

Sub class	Peak Impulse Voltage	Typical Application
Y1	8.0 kV	High Pulse
Y2	5.0 kV	General Purpose







Technology	Rating	Series	Capacitance	Certificates	Special Features
Ceramic Disc	X1 / Y1	SMDY1	470 pF to 4700 pF	IEC, UL, CSA, and CQC	Industry-first 500 V_{AC} SMD type Y1 safety capacitor available
	X1 / Y1	VY1, VY1C, AY1, WKP, 440L	10 pF to 20 nF	IEC, UL, CSA, and CQC	Industry-first 20 nF, 85 °C / 85 % RH 1000 h available. AEC-Q200 available
	X1 / Y2	VY2, AY2, WYO	10 pF to 12 nF	IEC, UL, CSA, and CQC	AEC-Q200 available
MLCC	X1 / Y2	VJ Safety Certified Capacitors	10 pF to 1000 pF	IEC, cCSA	1 nF in X1 / Y2 with C0G (NP0) Meets IEC 60384-14 min. 4 mm creepage, AEC-Q200 available
	X2		10 pF to 470 pF	IEC, cCSA	Meets IEC 60384-14 min. 4 mm creepage, AEC-Q200 available
	X1 / Y2		100 pF to 4700 pF	IEC, cCSA	Meets IEC 60384-14 min. 4 mm creepage, AEC-Q200 available
	X2		100 pF to 12 nF	IEC, cCSA	Meets IEC 60384-14 min. 4 mm creepage, AEC-Q200 available
Film	X1	F340X1, F339X1, and MKP3381	0.001 µF to 2.2 µF	IEC, UL, CSA, and CQC	THB Class IIIB available
	X2	F340X2, F339X2, and F1773	0.001 µF to 40 µF	IEC, UL, CSA, and CQC	THB Class IIB, IIIB, and AEC-Q200 available
	Y2	F340Y2, MKP3386Y2	0.001 µF to 0.47 µF	IEC, UL, and CSA	THB Class IIIB and AEC-Q available

For a full overview of RFI capacitors, please visit www.vishay.com/doc?48140

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