



Vishay Safety Capacitors: Film, Ceramic Single Disc, and MLCC Technologies and Key Features

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FILM

Film capacitors offer high capacitance values up to 40 μF for across the line applications, while providing self-healing capability to recover from dielectric breakdown



CERAMIC SINGLE DISC

Ceramic disc capacitors provide the highest dielectric strength and withstand the highest peak impulse voltage



MLCC

Our surface-mount MLCCs are available with C0G (NP0) and X7R dielectrics, and meet the IEC 60384-14 minimum 4 mm creepage standard



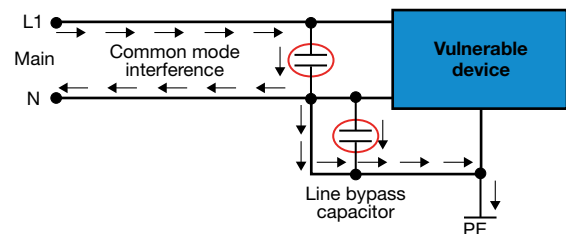
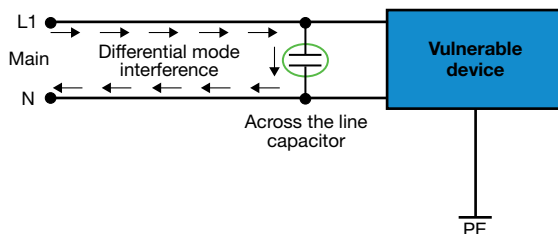
WHAT IS A SAFETY CAPACITOR?

Safety capacitors are also called EMI / RFI suppression capacitors, AC line filter safety capacitors, or X- and Y-rated capacitors. X and Y capacitors not only keep radio frequency noise generated by the device local to that device, but also protect the device from mains noise and high voltage surges. When this interference is propagated, it can either enter or leave a device by symmetrical or asymmetrical propagation.

WHAT IS THE DIFFERENCE BETWEEN X AND Y?

Symmetrical propagation is when the noise signal enters and leaves the AC mains in an alternating fashion (differential mode interference). Symmetrical propagation is resolved using an X capacitor, which is placed directly across the AC mains.

Conversely, asymmetrical propagation enters and leaves both sides of the AC mains at the same time, and propagates via the ground. This common noise interference is resolved using Y capacitors, which are placed at both sides of the AC mains on the system chassis (ground).



Thus, in both modes the capacitor functions as a low impedance path for high frequency signals, and therefore as a filter for those signals.

APPLICATION NOTE



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WHAT ARE THE KEY FEATURES OF EACH TECHNOLOGY?

Film capacitors feature the self-healing effect, which means they can recover from dielectric breakdown and continue their normal operation. In addition, their capacitance and dissipation factor are very stable across the temperature spectrum, granting constant performance regardless of external temperature conditions.

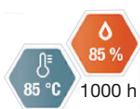
Vishay EMI film capacitors are also compliant with the latest IEC 60384-14 ed. 4 AMD1, which defines humidity robustness grades for applications where high stability under high humidity operating conditions is required. The F339X2 series conforms to grade IIB (85 °C / 85 % RH for 500 h at U_{RAC}) and the F340 family (X1 / X2 / Y2) is qualified to grade IIIB (85 °C / 85 % RH for 1000 h at U_{RAC}), providing capacitance and dissipation factor stability in the most challenging environments.

Vishay offers AEC-Q200 qualified products up to 4.7 µF, and up to 310 V_{AC} rated voltage for X2 applications and up to 305 V_{AC} for Y2. For X1 applications, rated voltages up to 480 V_{AC} are available in the Vishay portfolio.

EMI film capacitors from Vishay are UL-, CSA-, ENEC-, and CQC-qualified - and thus are suitable for worldwide usage regardless of application - and compliant with RoHS and REACH.

COUNTRY	SAFETY STANDARD	APPROVAL MARK
U.S.A.	UL 60384-14	
Canada	CSA E384-14	
U.S.A. and Canada	Combination mark (UL 60384-14 + CSA E384-14)	
China	CQC	
Europe	EN 60384-14 and IEC 60384-14	

Vishay's X1 / Y1 VY1 series of compact through-hole ceramic single disc capacitors not only withstands a specified 8 kV peak impulse voltage, but also 10 kV.



Furthermore, it passes the critical 85 / 85 1000-hour biased humidity test. Therefore, like the Vishay Automotive Grade AY1 and AY2 series, it offers the highest reliability while operating under harsh environmental conditions.

The AY1 series is the industry first Vishay Automotive Grade X1 / Y1 safety capacitor that meets the AEC-Q200 automotive standards. The AY2 series is a Vishay Automotive Grade X1 / Y2 safety capacitor that exceeds the specified 1000 temperature cycles, with 3000 cycles ranging from -55 °C to +125 °C. This AY2 series is available up to 10 nF.

Unique in the market is the 440L series of X1 / Y1 classified safety disc capacitors, which offers superior capacitance values of 10 nF and 20 nF. This allows customers to profit from a reduction in the number of capacitors needed to reach the required capacitance value - saving space and simplifying assembly.

For applications with limited board space, the VY*Y5V mini series is not only characterized by a miniature body size, but also a competitive price.

All Vishay through-hole ceramic safety capacitor series offer a variety of lead wire materials, lead spaces, lead design, and packages. Customized solutions are available upon request. All safety capacitors are approved according to IEC 60384-14.4, UL, and CQC, while all series are compliant with RoHS and the REACH regulations.

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Vishay's line of X1 / Y2 and X2 surface-mount safety capacitors offers devices for operating voltages up to 250 V_{AC}.

As surface-mount devices, the capacitors simplify circuit board assembly. The components are supplied in tape and reel packages and are picked and placed the same as all other surface-mount components. Their small size makes them a good choice in space-constrained applications, such as the compact power supplies commonly used with portable electronic equipment. Vishay offers the 2008 and 2220 body sizes in C0G (NP0) and X7R ceramic dielectrics.



Their multilayer construction also allows for higher capacitance values, starting from 10 pF up to 12 nF in smaller packages. Of note is a 1 nF capacitance value offered in the C0G (NP0) material, which offers a consistent capacitance with respect to both temperature and applied voltage. Surface-mount safety capacitors are available in commercial and Vishay Automotive Grades (AEC-Q200 qualified), with PPAP data upon request.

WHERE CAN YOU FIND THESE COMPONENTS?

To facilitate the work of electronic engineers, Vishay provides samples and sample kits. With a sample kit in hand, engineers have all the capacitor technologies with their specific features, capacitance values, and rated voltages available for testing purposes. This makes their design-in work easier. The easiest way to acquire our sample kits is via catalog distributors, who can deliver them within a few hours, or by contacting us directly via the e-mail address given on the datasheet.

