

# Automotive Grade EMI Suppression Safety Capacitor, Ceramic Disc, Class X1, 760 V<sub>AC</sub>, Class Y1, 500 V<sub>AC</sub>



## FEATURES

- AEC-Q200 qualified
- Withstands 85 / 85 / 1000 h test
- Can pass 1000 temperature cycles (from -55 °C to +125 °C)
- Can pass 10 kV pulses (10 per polarity)
- Complying with IEC 60384-14
- High reliability
- Singlelayer AC disc safety capacitors
- PPAP (AIAG version) is available
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)

## LINKS TO ADDITIONAL RESOURCES



3D Models



Models



Capabilities and Custom Options



Infographics



Application Notes



Related Documents

| QUICK REFERENCE DATA       |              |
|----------------------------|--------------|
| DESCRIPTION                | VALUE        |
| Ceramic Class              | 2            |
| Ceramic Dielectric         | Y5U          |
| Voltage (V <sub>AC</sub> ) | 500      760 |
| Min. Capacitance (pF)      | 470          |
| Max. Capacitance (pF)      | 4700         |
| Mounting                   | Radial       |

## OPERATING TEMPERATURE RANGE

-55 °C to +125 °C

## TEMPERATURE CHARACTERISTICS

Class 2: Y5U

## SECTIONAL SPECIFICATIONS

Climatic category (according to EN 60058-1)

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

CQC (IEC 60384-14)

## PACKAGING

Bulk, tape and reel, taped ammpack

## APPLICATIONS

- X1, Y1 according to IEC 60384-14
- Application as Y capacitors for EMI suppression and primary-secondary coupling on battery chargers for PHEV/EV
- Application as filter capacitors on DC/DC converters for PHEV/EV and HEV
- 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 tin plated copper-clad steel having a diameter of 0.6 mm or 0.8 mm.

The capacitors may be supplied with straight and vertical kink leads having a lead spacing of 10.0 mm and 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<sub>R</sub>

IEC 60384-14:

 (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

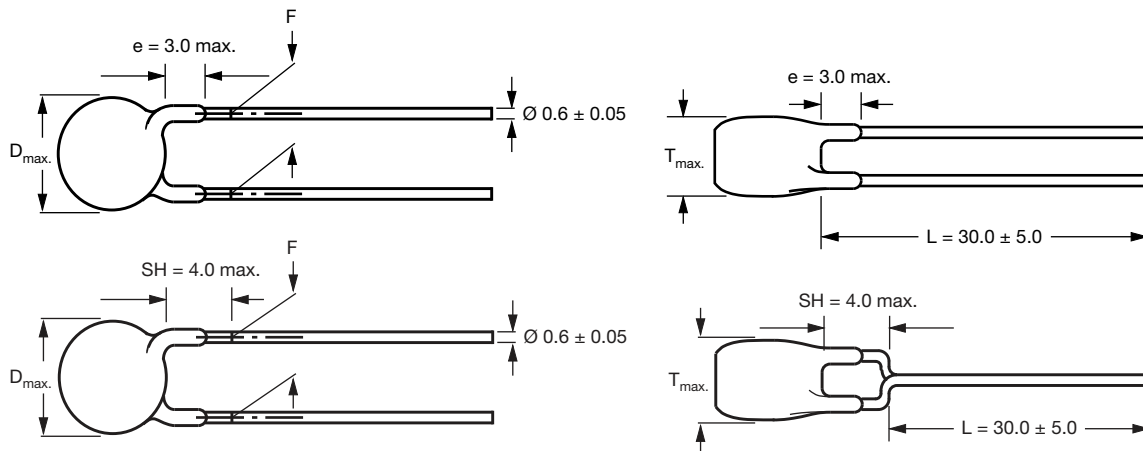
≥ 10 000 MΩ

## CAPACITANCE TOLERANCE

± 20 % (code M)

## DISSIPATION FACTOR

Class 2: max. 2.5 % (1 kHz)

**DIMENSIONS** in millimeters


Capacitors with 10.0 mm or 12.5 mm lead spacing

**TECHNICAL DATA**

| CAPACITANCE<br>C (pF) | CAPACITANCE<br>TOLERANCE<br>(%) | BODY<br>DIAMETER<br>D <sub>max.</sub> (mm) | BODY<br>THICKNESS<br>T <sub>max.</sub> (mm) | LEAD SPACING<br>F (mm) ± 1 mm | PART NUMBER                               |
|-----------------------|---------------------------------|--|---|-------------------------------|---|
|                       |                                 |  |   |                               | MISSING DIGITS SEE<br>ORDERING CODE BELOW |
| <b>Y5U</b>            |                                 |  |   |                               |   |
| 470                   | ± 20                            | 8.0  | 7.0   | 10 or 12.5                    | AY1471M31Y5UC6###                         |
| 680                   |                                 | 9.0  |   | 10 or 12.5                    | AY1681M35Y5UC6###                         |
| 1000                  |                                 | 9.5  |   | 10 or 12.5                    | AY1102M37Y5UC6###                         |
| 1500                  |                                 | 10.5                                       |   | 10 or 12.5                    | AY1152M41Y5UC6###                         |
| 2200                  |                                 | 12.0                                       |   | 10 or 12.5                    | AY1222M47Y5UC6###                         |
| 2700                  |                                 | 13.5                                       |   | 10 or 12.5                    | AY1272M53Y5UC6###                         |
| 3300                  |                                 | 14.5                                       |   | 10 or 12.5                    | AY1332M57Y5UC6###                         |
| 3900                  |                                 | 15.5                                       |   | 10 or 12.5                    | AY1392M61Y5UC6###                         |
| 4700                  |                                 | 16.5                                       |   | 10 or 12.5                    | AY1472M65Y5UC6###                         |

**ORDERING CODE**

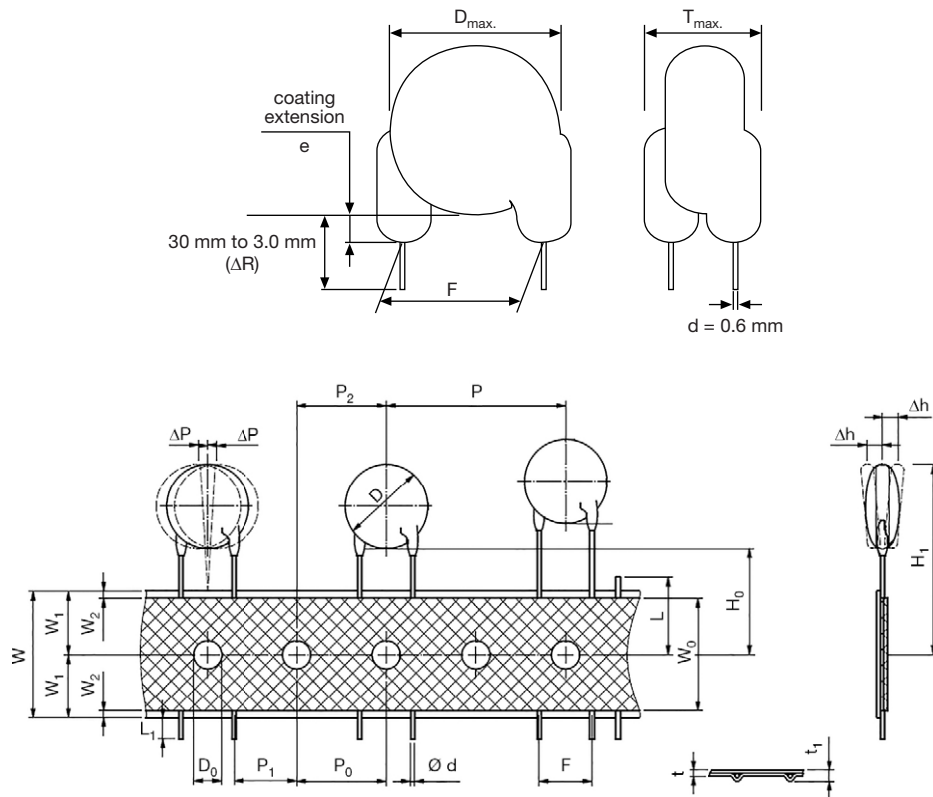
| ###            | 15 <sup>th</sup> to 17 <sup>th</sup> digit | Lead configuration |                |           | Available configurations see below |                |                    |  |                                    |                      |
|----------------|--|--------------------|----------------|-----------|------------------------------------|----------------|--------------------|--|------------------------------------|----------------------|
| <b>Example</b> | <b>AY1</b>                                 | <b>222</b>         | <b>M</b>       | <b>47</b> | <b>Y5U</b>                         | <b>C</b>       | <b>6</b>           | <b>U</b>                                     | <b>L</b>                           | <b>0</b>             |
|                | Series                                     | Capacitance value  | Tolerance code | Size code | Temperature coefficient            | Compact design | Lead wire diameter | Packaging / lead length                      | Lead style                         | Lead spacing         |
|                |  |                    |                |           |                                    |                | 6 = 0.6<br>8 = 0.8 | 3 = bulk<br>T = tape and reel<br>U = ammpack | L = straight<br>V = inline<br>kink | 0 = 10.0<br>X = 12.5 |

**LEADSPACING 10.0 mm AND 12.5 mm**
**PACKAGING**

| CAPACITANCE<br>VALUE | SIZE CODE | BODY DIAMETER<br>D <sub>max.</sub><br>(mm) | PACKAGING QUANTITIES |      |      |
|----------------------|-----------|--|----------------------|------|------|
|                      |           |  | BULK                 | REEL | AMMO |
| 470 pF to 2200 pF    | 31 to 47  | 12.0                                       | 1000                 | 500  | 500  |
| 2700 pF to 4700 pF   | 53 to 65  | 16.5                                       | 500                  | 500  | 500  |

**Note**

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

**STRAIGHT LEADS**


The hole pitch 12.7 mm for lead spacing 10.0 mm (0.4") or 12.5 mm (0.49")

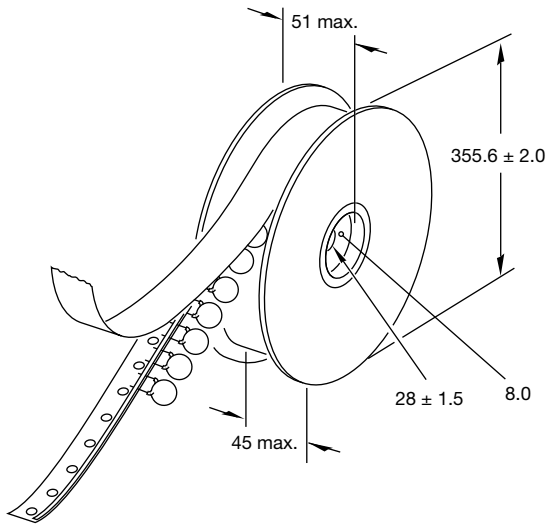
| DIMENSION OF TAPE             |   |                                    |
|-------------------------------|---|------------------------------------|
| SYMBOL                        | PARAMETER                                 | DIMENSIONS (mm)                    |
|                               |   | 10 mm OR 12.5 mm                   |
| D <sup>(1)</sup>              | Body diameter                             | 16.5 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 6.5 ± 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                                 |
| H <sub>0</sub>                | Height to seating plane                   | 20.0 ± 0.5 (16.0 ± 0.5 for kinked) |
| 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>                | Maximum thickness of tape and wires       | 1.5 max.                           |

**Notes**

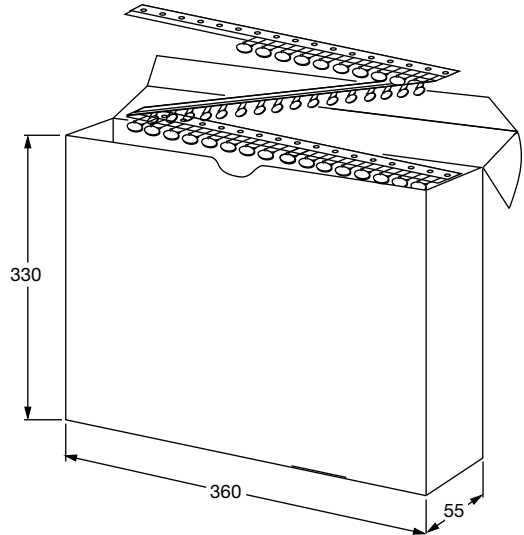
- (1) See "Technical Data" table
- (2) Cumulative pitch error: ± 1 mm/20 pitches
- (3) Obliquity maximum 3°



REEL AND TAPE DATA in millimeters



Reel with capacitors on tape



Ampmpack with capacitors on tape

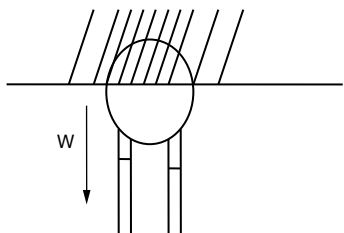
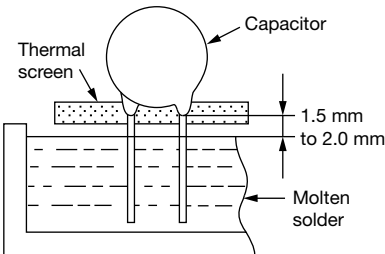
| APPROVALS  |                |                  |                     |  |
|--|----------------|------------------|---------------------|--|
| IEC 60384-14 - Safety tests<br>This approval together with CB test certificate substitutes all national approvals.   |                |                  |                     |  |
| <b>CB Certificate</b>  |                |                  |                     |  |
| Y1-capacitor: CB test certificate:   | US-26163-UL    | 470 pF to 4.7 nF | 500 V <sub>AC</sub> |  |
| X1-capacitor: CB test certificate:   | US-26163-UL    | 470 pF to 4.7 nF | 760 V <sub>AC</sub> |  |
| <b>VDE</b>   |                |                  |                     |  |
| Y1-capacitor: VDE marks approval:  | 40012673       | 470 pF to 4.7 nF | 500 V <sub>AC</sub> |  |
| X1-capacitor: VDE marks approval:  | 40012673       | 470 pF to 4.7 nF | 760 V <sub>AC</sub> |  |
| DIN EN 60384-14 VDE 0565-1-1:2006-04 - Safety tests  |                |                  |                     |  |
| <b>Underwriters Laboratories Inc./Canadian Standards Association</b>   |                |                  |                     |  |
| Y1-capacitor: UL-test certificate:   | E183844        | 470 pF to 4.7 nF | 500 V <sub>AC</sub> |  |
| X1-capacitor: UL-test certificate:   | E183844        | 470 pF to 4.7 nF | 760 V <sub>AC</sub> |  |
| UL 60384-14, CSA E60384-1:03 2 <sup>nd</sup> edition, CSA E60384-14:09 2 <sup>nd</sup> edition<br>Across-the-line, antenna-coupling and line-by-pass component |                |                  |                     |  |
| <b>CQC</b>   |                |                  |                     |  |
| Y1-capacitor: CQC test certificate:  | CQC05001015032 | 470 pF to 4.7 nF | 500 V <sub>AC</sub> |  |
| X1-capacitor: CQC test certificate:  | CQC05001015032 | 470 pF to 4.7 nF | 760 V <sub>AC</sub> |  |

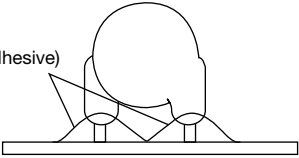
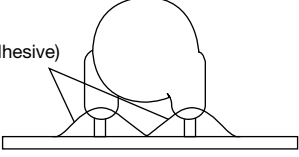
| MARKING   |  |
|---|--|
| <p>Sample<br/>(2 sides)</p> <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> <br/> <b>Front</b> </div> <div style="text-align: center;"> <br/> <b>Back</b> </div> </div> <p style="margin-left: 100px;">XX - Year<br/>ΔΔ - Week</p> | <br>PN:                      Lot1:                      DC1:<br>QTY:                      Lot2:                      DC2:<br>PO:                        Batch:                      SL:<br>SO:                        Region:                     Ser.No:<br><br><div style="text-align: right;">1/1</div> |

| PERFORMANCE                              |  |   |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
|--|--|---|---|---|------|-------------|---|--------------|---|---------------|---|--------------|---|--------------|---|--------------|
| NO.                                      | ITEMS                                    |   | SPECIFICATION   | TEST METHOD   |      |             |   |              |   |               |   |              |   |              |   |              |
| 1  | Visual and mechanical examination        |   | No visible damage.<br>The marking shall be legible.<br>Dimensions are within specification. | Capacitors shall be visually inspected for visible evidence of defect.<br>Dimensions shall be measured with calipers or micrometers.  |      |             |   |              |   |               |   |              |   |              |   |              |
| 2  | Capacitance                              |   | Within the specified tolerance.   | The capacitance shall be measured at 25 °C ± 3 °C, 75 % RH maximum with 1.0 V <sub>RMS</sub> ± 0.2 V <sub>RMS</sub> , 1 kHz.  |      |             |   |              |   |               |   |              |   |              |   |              |
| 3  | Dissipation factor (D.F.)                |   | 2.5 % max.  | The dissipation factor shall be measured at 25 °C ± 3 °C, 75 % RH maximum with 1.0 V <sub>RMS</sub> ± 0.2 V <sub>RMS</sub> , 1 kHz.   |      |             |   |              |   |               |   |              |   |              |   |              |
| 4  | Insulation resistance (I.R.)             |   | 10 GΩ min.  | Insulation resistance shall be measured within 60 s ± 5 s of charging at 500 V <sub>DC</sub> .  |      |             |   |              |   |               |   |              |   |              |   |              |
| 5  | Dielectric strength (between lead wires) |   | No damage.  | 4000 V <sub>AC</sub> are applied for 60 s.<br>50 mA max. (destructive test)   |      |             |   |              |   |               |   |              |   |              |   |              |
| 6  | Temperature characteristic               |   | Within specification.   | The capacitance shall be measured at each step specified in table below.<br>The capacitance change from the value of step 3 shall not exceed the limit specified. <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Step</th> <th>Temperature</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>25 °C ± 3 °C</td> </tr> <tr> <td>2</td> <td>-30 °C ± 3 °C</td> </tr> <tr> <td>3</td> <td>25 °C ± 3 °C</td> </tr> <tr> <td>4</td> <td>85 °C ± 3 °C</td> </tr> <tr> <td>5</td> <td>25 °C ± 3 °C</td> </tr> </tbody> </table> | Step | Temperature | 1 | 25 °C ± 3 °C | 2 | -30 °C ± 3 °C | 3 | 25 °C ± 3 °C | 4 | 85 °C ± 3 °C | 5 | 25 °C ± 3 °C |
| Step                                     | Temperature                              |   |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| 1  | 25 °C ± 3 °C                             |   |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| 2  | -30 °C ± 3 °C                            |   |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| 3  | 25 °C ± 3 °C                             |   |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| 4  | 85 °C ± 3 °C                             |   |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| 5  | 25 °C ± 3 °C                             |   |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| 7  | High temperature operation life          | External appearance                       | No visible damage.<br>The marking shall be legible.   | The specimen capacitors shall be submitted to an endurance test of 1000 h + 48 h / - 0 h in a chamber at 125 °C ± 3 °C with a voltage of 760 V <sub>AC</sub> .<br><br>Pre-treatment: capacitor shall be backed at 125 °C ± 3 °C for 1 h before initial measurements.<br><br>Post-treatment: capacitors shall be placed at room condition for 24 h ± 2 h before measurements.  |      |             |   |              |   |               |   |              |   |              |   |              |
| Capacitance change                       |  | ± 15 % max.                               |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| Dissipation factor                       |  | 5 % max. at 1 V, 1 kHz                    |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| Insulation resistance                    |  | 3 GΩ min. at 500 V <sub>DC</sub> , 60 s   |   |   |      |             |   |              |   |               |   |              |   |              |   |              |
| Dielectric strength (between lead wires) |  | No failure at 4000 V <sub>AC</sub> , 60 s |   |   |      |             |   |              |   |               |   |              |   |              |   |              |



| PERFORMANCE |                                    |  |   |   |
|-------------|------------------------------------|--|---|---|
| NO.         | ITEMS                              |  | SPECIFICATION                                       | TEST METHOD   |
| 8           | Life test                          | External appearance                      | No visible damage.<br>The marking shall be legible. | <p>Test voltage: 4000 V<sub>AC</sub>, 60 s<br/>Impulse voltage: each individual capacitor shall be subjected to a 10 kV impulse for ten times each polarity. Before the capacitors are applied to life test.</p> <p><math>T_1 = 1.2 \mu\text{s}</math><br/><math>T_2 = 50 \mu\text{s}</math></p> <p>The specimen capacitors shall be submitted to an endurance test of 1000 h + 48 h / - 0 h in a chamber at 125 °C ± 3 °C with a voltage of 1500 V<sub>AC</sub>.</p> <p>Pre-treatment: capacitor shall be backed at 125 °C ± 3 °C for 1 h before initial measurements.</p> <p>Post-treatment: capacitors shall be placed at room condition for 24 h ± 2 h before measurements.</p> |
|             |                                    | Capacitance change                       | ± 15 % max.   |   |
|             |                                    | Dissipation factor                       | 5 % max. at 1 V, 1 kHz                              |   |
|             |                                    | Insulation resistance                    | 3 GΩ min. at 500 V <sub>DC</sub> , 60 s             |   |
|             |                                    | Dielectric strength (between lead wires) | No failure at 4000 V <sub>AC</sub> , 60 s           |   |
| 9           | Humidity test (under steady state) | External appearance                      | No visible damage.                                  | <p>Ambient temperature: 40 °C ± 2 °C<br/>Relative humidity: 90 % to 95 % RH<br/>Duration: 500 h + 48 h / - 0 h<br/>Without loading</p> <p>Pre-treatment: capacitor shall be stored at 40 °C ± 2 °C for 24 h ± 5 h before initial measurements.</p> <p>Post-treatment: capacitor shall be stored for 2 h at room conditions before final measurements.</p>   |
|             |                                    | Capacitance change                       | ± 20 %  |   |
|             |                                    | Dissipation factor                       | 5 % max. at 1 V, 1 kHz                              |   |
|             |                                    | Insulation resistance                    | 3 GΩ min. at 500 V <sub>DC</sub> , 60 s             |   |
|             |                                    | Dielectric strength (between lead wires) | No failure at 4000 V <sub>AC</sub> , 60 s           |   |
| 10          | Humidity test (under load state)   | External appearance                      | No visible damage.<br>The marking shall be legible. | <p>Ambient temperature: 40 °C ± 2 °C<br/>Relative humidity: 90 % to 95 % RH<br/>Duration: 500 h + 48 h / - 0 h<br/>Loading voltage: 760 V<sub>AC</sub></p> <p>Pre-treatment: capacitor shall be stored at 40 °C ± 5 °C for 24 h ± 2 h before initial measurements.</p> <p>Post-treatment: capacitor shall be stored for 2 h at room conditions before final measurements.</p>   |
|             |                                    | Capacitance change                       | ± 15 %  |   |
|             |                                    | Dissipation factor                       | 5 % max. at 1 V, 1 kHz                              |   |
|             |                                    | Insulation resistance                    | 3 GΩ min. at 500 V <sub>DC</sub> , 60 s             |   |
|             |                                    | Dielectric strength (between lead wires) | No failure at 4000 V <sub>AC</sub> , 60 s           |   |

| PERFORMANCE |                           |  |                       |   |   |
|-------------|---------------------------|--|-----------------------|---|---|
| NO.         | ITEMS                     |  |                       | SPECIFICATION   | TEST METHOD   |
| 11          | Biased humidity           | External appearance                      |                       | No visible damage.<br>The marking shall be legible.   | Loading voltage: 760 V <sub>AC</sub><br>Ambient temperature: 85 °C ± 3 °C<br>Relative humidity: 85 % RH<br>Duration: 1000 h + 48 h / - 0 h<br><br>Pre-treatment: capacitor shall be stored at 40 °C ± 5 °C for 24 h ± 2 h, then place at room condition for 24 h ± 2 h before initial measurements.<br><br>Post-treatment: capacitor shall be stored for 24 h at room conditions before final measurements. |
|             |                           | Capacitance change                       |                       | ± 15 %  |   |
|             |                           | Dissipation factor                       |                       | 5 % max. at 1 V, 1 kHz  |   |
|             |                           | Insulation resistance                    |                       | 3 GΩ min. at 500 V <sub>DC</sub> , 60 s   |   |
|             |                           | Dielectric strength (between lead wires) |                       | No failure at 4000 V <sub>AC</sub> , 60 s   |   |
| 12          | Termination strength      | Pull test                                | External appearance   | Lead wire should not be cut off, capacitor should not be broken.  | As a figure, fix the body of capacitor, apply a tensile weight gradually to each lead wire in the radial direction of capacitor up to 20 N, and keep it for 10 s ± 1 s.<br><br>   |
|             |                           |  | Capacitance change    | Within specification  |   |
|             |                           |  | Dissipation factor    | Within specification  |   |
|             |                           |  | Insulation resistance | Within specification  |   |
|             |                           | Bending test                             | External appearance   | Lead wire should not be cut off, capacitor should not be broken.  |   |
|             |                           |  |                       |   |   |
| 13          | Resistance to solder heat | Visual                                   |                       | No visible damage.<br>The marking shall be legible.   | The lead wire shall be immersed into the melted solder of 260 °C ± 5 °C up to about 1.5 mm to 2 mm from the main body for 10 s ± 2 s.<br>Inspect under 10 x magnification<br><br>  |
|             |                           | Capacitance change                       |                       | Within ± 10 %   |   |
|             |                           | Dissipation factor                       |                       | 5 % max. at 1 V, 1 kHz  |   |
|             |                           | Insulation resistance                    |                       | 1 GΩ min. at 500 V <sub>DC</sub> , 60 s   |   |
|             |                           | Dielectric strength (between lead wires) |                       | No failure at 4000 V <sub>AC</sub> , 60 s   |   |
|             |                           |  |                       | Pre-treatment:<br>Capacitor shall be stored at 125 °C ± 5 °C for 1 h, then placed at room condition for 24 h ± 2 h before initial measurements.<br><br>Post-treatment:<br>Capacitor shall be stored for 24 h ± 2 h at room condition. |   |

| PERFORMANCE |                        |                       |   |  |
|-------------|------------------------|-----------------------|---|--|
| NO.         | ITEMS                  |                       | SPECIFICATION   | TEST METHOD  |
| 14          | Solderability          | External appearance   | 95 % of terminations evenly covered with solder under 10 x magnification. | Method A at category 3, steam aging for 8 h ± 15 min.<br>Solder and temperature:<br>a) Lead (Pb)-free solder (Sn-3Ag-0.5Cu) 245 °C ± 5 °C<br>b) H63 eutectic solder 235 °C ± 5 °C<br>dip lead wire into an ethanol solution of 25 % ± 0.5 % rosin and then into molten solder for 5 s + 0 s / - 0.5 s.<br>Depth of immersion within 1.25 mm, immerse and withdraw at 25 mm/s ± 6 mm/s  |
| 15          | Vibration test         | Visual                | No visible damage.<br>The marking shall be legible.                       |  <p>Solder the capacitor and gum up the body to the test jig by resin (adhesive). The capacitor should be firmly soldered to the supporting lead wire.<br/>Vibration change from 10 Hz to 2000 Hz, then back to 10 Hz.<br/>Total amplitude: 1.5 mm with 5 g max., 12 cycles, 20 min for each mutually perpendicular directions, 3 directions.</p>                   |
|             |                        | Capacitance change    | Within ± 10 %   |  |
|             |                        | Dissipation factor    | 5 % max. at 1 V, 1 kHz  |  |
|             |                        | Insulation resistance | 10 GΩ min. at 500 V <sub>DC</sub> , 60 s                                  |  |
| 16          | Mechanical shock       | External appearance   | No visible damage.<br>The marking shall be legible.                       |  <p>Solder the capacitor and gum up the body to the test jig by resin (adhesive).<br/>3 shocks in 2 directions should be applied, totally 3 mutually perpendicular axes, 18 shocks.<br/>Shock from: half-sine<br/>Duration: 6 ms<br/>Acceleration: 100 g</p>  |
|             |                        | Capacitance change    | Within the specified tolerance.   |  |
|             |                        | Dissipation factor    | 5 % max. at 1 V, 1 kHz  |  |
|             |                        | Insulation resistance | 10 GΩ min. at 500 V <sub>DC</sub> , 60 s                                  |  |
| 17          | Resistance to solvents | External appearance   | No visible damage.<br>The marking shall be legible.                       | <p>Leave parts in solvent for 3 to 8 min at 25 °C ± 5 °C, 1 min air-drying<br/>Rub parts against wet bristle 10 times (3 x for marking, 10 x for part damage)</p> <p>Solvent 1:<br/>1 part (by volume) of isopropyl alcohol,<br/>3 parts (by volume) of mineral spirits</p> <p>Solvent 2:<br/>Terpene defluxer</p> <p>Solvent 3:<br/>42 parts (by volume) of water, 1 part (by volume) of propylene glycol, 1 part (by volume) of monoethanolamine</p> |

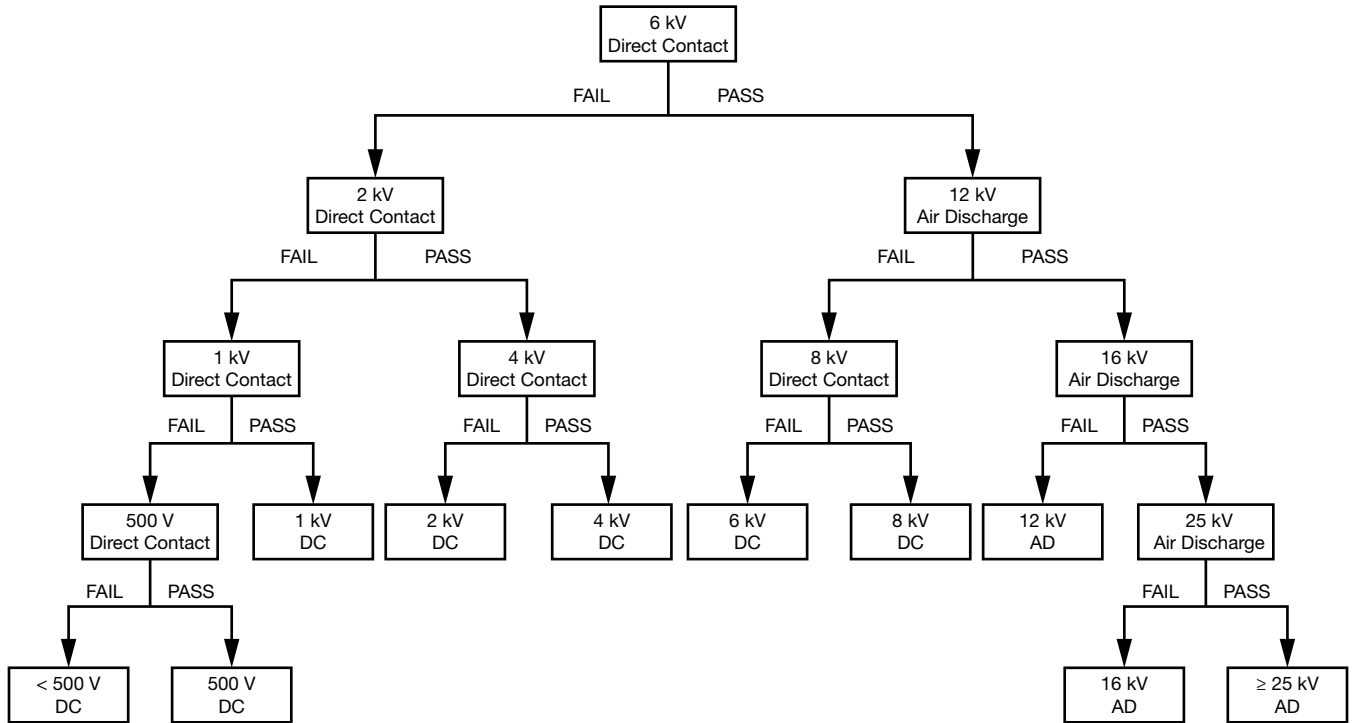




| PERFORMANCE |                                     |                       |   |  |
|-------------|-------------------------------------|-----------------------|---|--|
| NO.         | ITEMS                               |                       | SPECIFICATION                                       | TEST METHOD  |
| 18          | Temperature cycle                   | Capacitance change    | Within $\pm 20\%$                                   | <p>The capacitor should be run 1000 temperature cycles. Step as below:<br/>           Step 1-55 °C + 0 °C / - 3 °C, dwell time <math>\leq 30</math> min<br/>           Step 2 Transition time <math>\leq 1</math> min<br/>           Step 3+125 °C + 3 °C / - 0 °C, dwell time <math>\leq 30</math> min<br/>           Step 4 Transition time <math>\leq 1</math> min</p> <p>Pre-treatment:<br/>           capacitor shall be stored at 125 °C <math>\pm 3</math> °C for 1 h, then placed at room condition for 24 h <math>\pm 2</math> h before initial measurement.</p> <p>Post-treatment:<br/>           capacitor shall be stored for 24 h <math>\pm 2</math> h at room condition.</p> |
|             |                                     | Dissipation factor    | 5 % max. at 1 V, 1 kHz                              |  |
|             |                                     | Insulation resistance | 3 G $\Omega$ min at 500 V <sub>DC</sub> , 60 s      |  |
|             |                                     | Dielectric strength   | No failure at 4000 V <sub>AC</sub> , 60 s           |  |
|             |                                     | External appearance   | No visible damage.<br>The marking shall be legible. |  |
| 19          | High temperature exposure (storage) | External appearance   | No visible damage.<br>The marking shall be legible. | <p>Storage capacitor at 125 °C <math>\pm 3</math> °C for 1000 h + 48 h / - 0 h without loading.</p> <p>Pre-treatment:<br/>           capacitor shall be stored at 125 °C <math>\pm 3</math> °C for 1 h, then placed at room condition for 24 h <math>\pm 2</math> h before initial measurement.</p> <p>Post-treatment:<br/>           capacitor shall be stored for 24 h <math>\pm 2</math> h at room condition.</p>   |
|             |                                     | Capacitance change    | Within $\pm 20\%$                                   |  |
|             |                                     | Dissipation factor    | 5 % max. at 1 V, 1 kHz                              |  |
|             |                                     | Insulation resistance | 1 G $\Omega$ min. at 500 V <sub>DC</sub> , 60 s     |  |
| 20          | ESD                                 | External appearance   | No visible damage.<br>The marking shall be legible. | See chart "ESD Test Method" below  |
|             |                                     | Capacitance change    | Within $\pm 10\%$                                   |  |
|             |                                     | Dissipation factor    | 5 % max. at 1 V, 1 kHz                              |  |
|             |                                     | Insulation resistance | 1 G $\Omega$ min. at 500 V <sub>DC</sub> , 60 s     |  |



ESD TEST METHOD

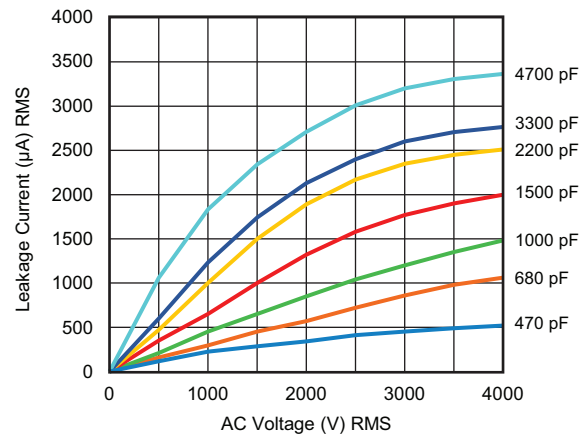


Notes

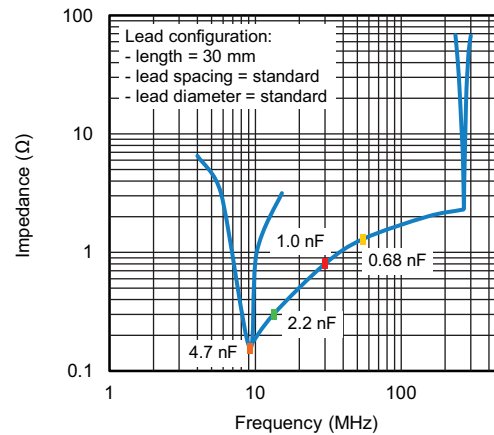
- DC means “direct contact discharge”
- AC means “air discharge”
- Classify the components according to the highest ESD voltage level survived during ESD testing



### 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  | <a href="http://www.vishay.com/doc?28536">www.vishay.com/doc?28536</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> |

| SAMPLE KIT  |  |
|-------------|--|
| Part Number | AY1-KIT-GA   |
| Link        | <a href="http://www.vishay.com/doc?28567">www.vishay.com/doc?28567</a> |



## **Disclaimer**

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Except as expressly indicated in writing, Vishay products are not designed for use in medical, life-saving, or life-sustaining applications or for any other application in which the failure of the Vishay product could result in personal injury or death. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.