chanhvinh.com

High Voltage Ceramic Capacitors
Radial-Leaded Singlelayer Disc



LINKS TO ADDITIONAL RESOURCES

3D Models

QUICK REFERENCE DATA			
DESCRIPTION	VALUE		
Ceramic class	2		
Ceramic dielectric	Y6P		
Temperature coefficient of capacitance	± 10 % within -30 °C to +105 °C		
Voltage ($U_{rated, DC}$)	10 000	15 000	20 000
Min. capacitance (pF)	100	100	100
Max. capacitance (pF)	2000	2000	1000
Capacitance tolerance	± 20 %		
Max. dissipation factor (%)	1.5		
Min. insulation resistance (GΩ)	200		
Operating temperature (°C)	-30 to +105		
Mounting	Radial		

RATED VOLTAGE

$U_{rated, AC} = U_{rated, DC}/2.8$ at 50 Hz / 60 Hz
$U_{rated, DC}$: 10 000 V → $U_{rated, AC}$: 3500 V
$U_{rated, DC}$: 15 000 V → $U_{rated, AC}$: 5300 V
$U_{rated, DC}$: 20 000 V → $U_{rated, AC}$: 7000 V

INSULATION RESISTANCE

Min. 200 000 MΩ at 500 V_{DC} / 60 s max.

TOLERANCE ON CAPACITANCE

± 20 %

DISSIPATION FACTOR

Max. 1.5 %

OPERATING TEMPERATURE RANGE

-30 °C to +105 °C

FEATURES

- Ceramic singlelayer DC disc / AC disc capacitor
- High reliability
- High capacitance values up to 2 nF
- Small sizes
- Low losses
- Radial leads
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

RoHS COMPLIANT

OPTIONS (on request)

- ± 10 % tolerance on nominal C-value
- Customized lead styles

APPLICATIONS

High voltage power supplies for x-ray sources and pulsed lasers

- Baggage scanner
- Medical x-ray
- Industrial laser

DESIGN

The capacitors consist of a ceramic disc of which both sides are silver-plated. Connection leads are made of tinned copper clad steel wire having diameters of 0.026" (0.65 mm) and 0.032" (0.80 mm).

The capacitors may be supplied with inline and straight leads having lead spacing of 0.37" (9.5 mm) and 0.49" (12.5 mm).

Coating is made of flame retardant epoxy resin in accordance with “UL 94 V-0”.

CAPACITANCE RANGE

100 pF to 2000 pF

DIELECTRIC STRENGTH BETWEEN LEADS

1.5 x $U_{rated, DC}$ for maximum 60 s

Test voltage: customer re-test 1.35 x $U_{rated, DC}$ for maximum 60 s

Note

- Considered as destructive test in insulation liquid
- Avoid flashover between wires and currents higher than 50 mA

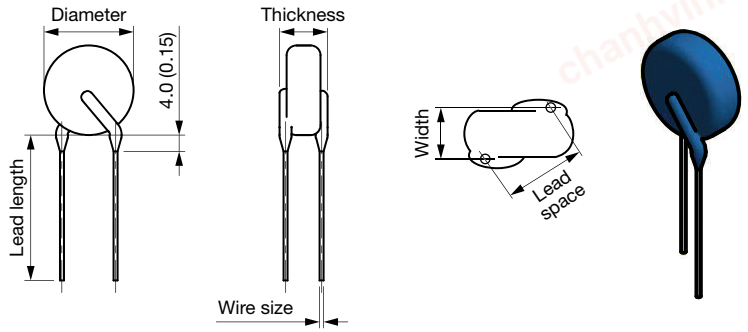
CERAMIC DIELECTRIC

Y6P (± 10 % within -30 °C to +105 °C)

For technical questions, contact: slcap@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

chanhvinh.com

DIMENSIONS in millimeters (inches)



ORDERING INFORMATION, CERAMIC 10 kV_{DC}

C (pF)	TOL. (%)	MAXIMUM DIAMETER		MAXIMUM THICKNESS		LEAD SPACE ± 1 mm (± 0.04")		WIRE SIZE ± 0.05 mm (± 0.002") (1)		LEAD LENGTH ± 5 mm (± 0.2")		WIDTH ± 0.5 mm (± 0.02")		ORDERING CODE
		mm	INCH	mm	INCH	mm	INCH	mm	INCH	mm	INCH	mm	INCH	
100	± 20	8	0.31	8.2	0.32	12.5 and 9.5	0.49 and 0.37	0.80 and 0.65	0.032 and 0.026	30	1.18	5.3	0.21	HVCC103Y6P101####
150		8	0.31	8	0.31							4.5	0.18	HVCC103Y6P151####
220		9	0.35									4.5	0.18	HVCC103Y6P221####
330		10	0.39	7.5	0.30							4.3	0.17	HVCC103Y6P331####
470		12	0.47									4.3	0.17	HVCC103Y6P471####
680		13	0.51									3.8	0.15	HVCC103Y6P681####
1000		15	0.59									3.8	0.15	HVCC103Y6P102####
1500		17	0.67									3.8	0.15	HVCC103Y6P152####
2000		19	0.75									3.8	0.15	HVCC103Y6P202####

ORDERING INFORMATION, CERAMIC 15 kV_{DC}

C (pF)	TOL. (%)	MAXIMUM DIAMETER		MAXIMUM THICKNESS		LEAD SPACE ± 1 mm (± 0.04")		WIRE SIZE ± 0.05 mm (± 0.002") (1)		LEAD LENGTH ± 5 mm (± 0.2")		WIDTH ± 0.5 mm (± 0.02")		ORDERING CODE
		MM	INCH	mm	INCH	mm	INCH	mm	INCH	mm	INCH	mm	INCH	
100	± 20	8	0.31	8.2	0.32	12.5 and 9.5	0.49 and 0.37	0.80 and 0.65	0.032 and 0.026	30	1.18	5.3	0.21	HVCC153Y6P101####
150		8	0.31	8	0.31							4.5	0.18	HVCC153Y6P151####
220		9	0.35									4.5	0.18	HVCC153Y6P221####
330		10	0.39									4.3	0.17	HVCC153Y6P331####
470		12	0.47									4.3	0.17	HVCC153Y6P471####
680		13	0.51									4.3	0.17	HVCC153Y6P681####
1000		15	0.59									4.3	0.17	HVCC153Y6P102####
1500		19	0.75									4.3	0.17	HVCC153Y6P152####
2000		19	0.75									4.3	0.17	HVCC153Y6P202####

ORDERING INFORMATION, CERAMIC 20 kV_{DC}

C (pF)	TOL. (%)	MAXIMUM DIAMETER		MAXIMUM THICKNESS		LEAD SPACE ± 1 mm (± 0.04")		WIRE SIZE ± 0.05 mm (± 0.002") (1)		LEAD LENGTH ± 5 mm (± 0.2")		WIDTH ± 0.5 mm (± 0.02")		ORDERING CODE
		mm	INCH	mm	INCH	mm	INCH	mm	INCH	mm	INCH	mm	INCH	
100	± 20	8	0.31	8.5	0.33	12.5 and 9.5	0.49 and 0.37	0.8 and 0.65	0.032 and 0.026	30	1.18	5.3	0.21	HVCC203Y6P101####
150		8	0.31									4.5	0.18	HVCC203Y6P151####
220		9	0.35									5.0	0.2	HVCC203Y6P221####
330		12	0.47									5.1	0.2	HVCC203Y6P331####
470		13	0.51									5.1	0.2	HVCC203Y6P471####
680		15	0.59									5.1	0.2	HVCC203Y6P681####
1000		17	0.67									5.1	0.2	HVCC203Y6P102####

Notes

- ± 10 % tolerance is available upon request

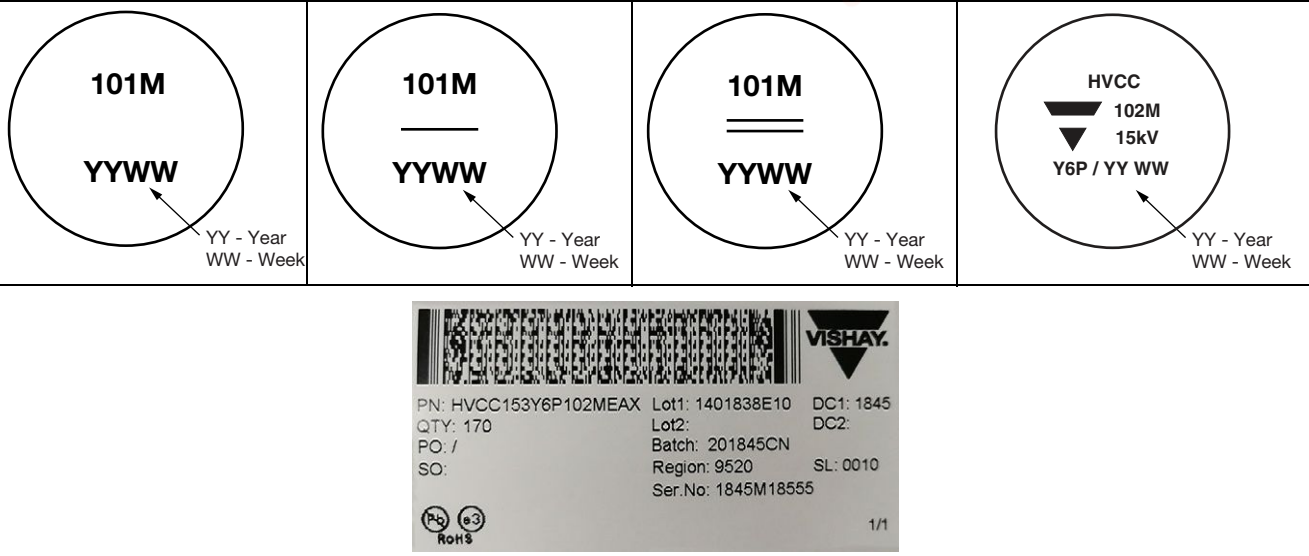
(1) #20 AWG = 0.8 mm
#22 AWG = 0.6 mm

For technical questions, contact: slcap@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

chanhvinh.com

MARKING

SAMPLE < 470 pF		SAMPLE < 330 pF	SAMPLE ≥ 470 pF	SAMPLE ≥ 330 pF
10 kV	15 kV	20 kV	10 kV / 15 kV	20 kV



ORDERING CODE

H	V	C	C	1	5	3	Y	6	P	1	0	2	M	E	A	X
1				2			3			4			5	6		7

1	2	3	4	5	6	7
SERIES (**H**IGH **V**OLTAGE **C**ERAMIC **C**APACITOR)	RATED VOLTAGE	TEMPERATURE CHARACTERISTICS	CAPACITANCE VALUE	CAPACITANCE TOLERANCE	1st DIGIT: LEAD TYPE / LEAD SPACING / GAUGE 2nd DIGIT: LEAD LENGTH	PACKAGING

LEAD TYPE (position 6)

STANDARD TYPE

CODE	LEAD TYPE	LEAD SPACING (mm)	LEAD DIAMETER (mm)	# GAUGE	MATERIAL	LEAD LENGTH (mm)
AA	Straight LL	9.5 ± 1.0	0.80	20	TCCSW	30 ± 5
CA	Straight LL	9.5 ± 1.0	0.65	22	TCCSW	30 ± 5
EA	Straight LL	12.5 ± 1.0	0.80	20	TCCSW	30 ± 5
GA	Straight LL	12.5 ± 1.0	0.65	22	TCCSW	30 ± 5

Notes

- 1th digit: lead type / lead spacing / gauge
  2nd digit: A = long leads
- LL = long leads
- TCCSW = **t**inned **c**opper **c**lad **s**teel **w**ire

PACKAGING (position 7)

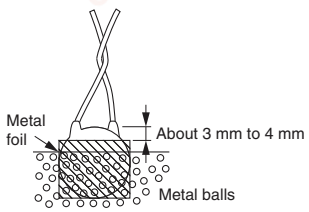
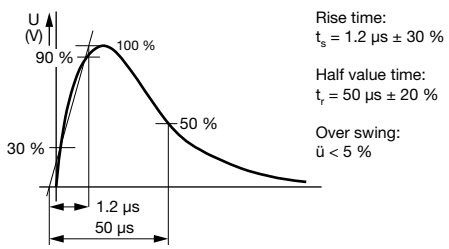
CODE	VERSION
X	Bulk

For technical questions, contact: slcap@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

chanhvinh.com

PERFORMANCE

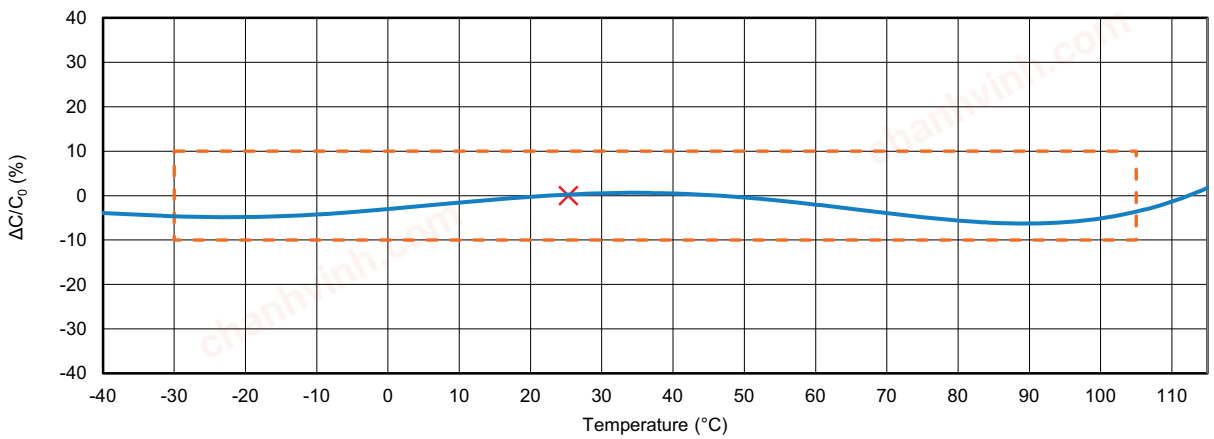
NO.	PARAMETER	SPECIFICATION	
		TEST CONDITIONS	METHOD AND NOTES
1	Capacitance	Tol. K = ± 10 % at 1000 h Tol. M = ± 20 % at 1000 h	Components are measured with a LCR-meter. Consider aging of ceramic. Given tolerance is valid 1000 h ± 24 h after last heating. Before and after that moment, aging offset has to be considered. (See general information for further instructions)
2	Dissipation factor	DF / tan δ = max. 1.5 %	
3	Insulation resistance	I_R = min. 200 GΩ in 60 s t = 5 s U = 500 V_{DC} ± 10 V_{DC}	NOTE: very high resistances are sensitive to the surrounding area may lead to unstable measurement values
4	Dielectric strength (between lead wires)	U1 = +1.35 x U_{RDC}/U_{RAC} max. 60 s U2 = -1.35 x U_{RDC}/U_{RAC} max. 60 s $t_{U1} = t_{U2}$ = 60 s $I_{max.}$ = 50 mA	1. Apply +1.35 x U_{RDC}/U_{RAC} for max. 60 s 2. Unload part ($I_{max.}$ = 50 mA) 3. Apply -1.35 x U_{RDC} for max. 60 s 4. Unload part ($I_{max.}$ = 50 mA) 5. Avoid current spikes higher than 50 mA
5	Appearance and marking	No visible damage. The marking shall be legible	Visual inspection
6	Dimensions	Dimensions are within specification	Measurement by caliper gauge
7.1	Temperature characteristics / **TCC**	EIA code = Y6P $\Delta C/C_0$ = ± 10 % Temp. range = -30 °C to 105 °C	Measurement is done from cooler temperatures to hotter temperatures in reasonable temperature steps. Other way round you get have to consider deaging effects.
7.2	Temperature characteristics / **TCDF**	DF / tan δ = max. 1.5 % Temp. range = 20 °C to 105 °C	
8	Dielectric strength of body insulation	U = 5000 V_{DC} t = 60 s	1. Connect both lead wires together 2. Dip component headfirst into a bath with oil and metal balls (fig.) 3. Apply voltage between lead wires and metal balls 
9	Pulse test	t_r = 1.2 µs t_f = 50 µs U = 1.25 x U_{RDC} n = 50 x single polarity	
10	Life test	U = 1.25 x U_{RDC} t = min. 1000 h T = max. 105 °C $I_{max.}$ = 50 mA	1. Initial measurement including no. 1, 2, 3, and 8 2. Condition the components to test temperature 3. Carry out life test / avoid 0 Ω short circuit 4. Final measurement including no. 1, 2, 3, and 8 Result: voltage breakdowns are not accepted
11	Steady state test (without load)	T = 40 °C RH = 93 % t = 240 h / 10 days U = 1.5 x U_{RDC}	1. Initial measurement including no. 1, 2, 3, and 8 2. Carry out steady state test 3. Final measurement including no. 1, 2, 3, and 8 Result: voltage breakdowns are not accepted

For technical questions, contact: slcap@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

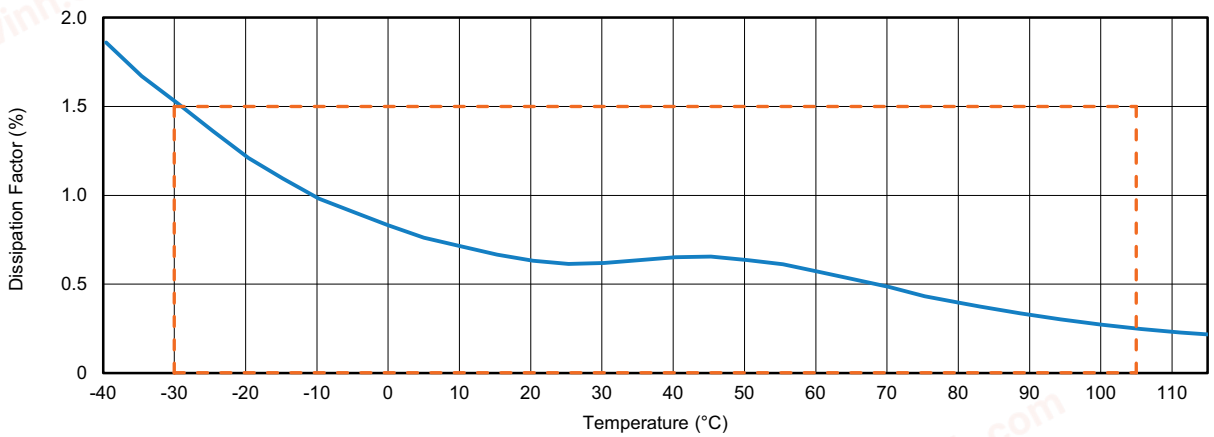
chanhvinh.com

PERFORMANCE			
NO.	PARAMETER	SPECIFICATION	
		TEST CONDITIONS	METHOD AND NOTES
12	Temperature cycle	T_{LOW} = -40 °C T_{HIGH} = +105 °C t_{DWELL} = 1800 s t_{CHANGE} = about 300 s n = 50 x	1. Initial measurement including no. 1, 2, 3, and 8 2. Carry out temperature cycle 3. Final measurement including no. 1, 2, 3, and 8 Result: voltage breakdowns and cracks in coating are not accepted
13	Solderability	T_{SOLDER} = max. 250 °C t = max. 3 s dist. solder-epoxy = min. 2 mm	1. Initial measurement incl. no. 1, 2, 3, and 8 2. Carry out test (solder material: no known restrictions) 3. Final measurement incl. 1, 2, 3, and 8 Result: voltage breakdowns are not accepted
14	Strength of lead wire / pulling	F_{PULL} = max. 10 N t_{PULL} = max. 10 s	Fix the body of component, 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
15	Strength of lead wire / bending	F_{BEND} = max. 5 N t_{BEND} = 2 s to 3 s	Bending each lead wire to 90° from the lead egress with 2.5 N force, then back to original position and bent again from the same direction. Totally 3 bends, 3 s each time. 1 bend: bending to 90° the return to normal position is one bend. Start from 1.6 mm to 3.2 mm from the part body

TYPICAL TCC Y6P



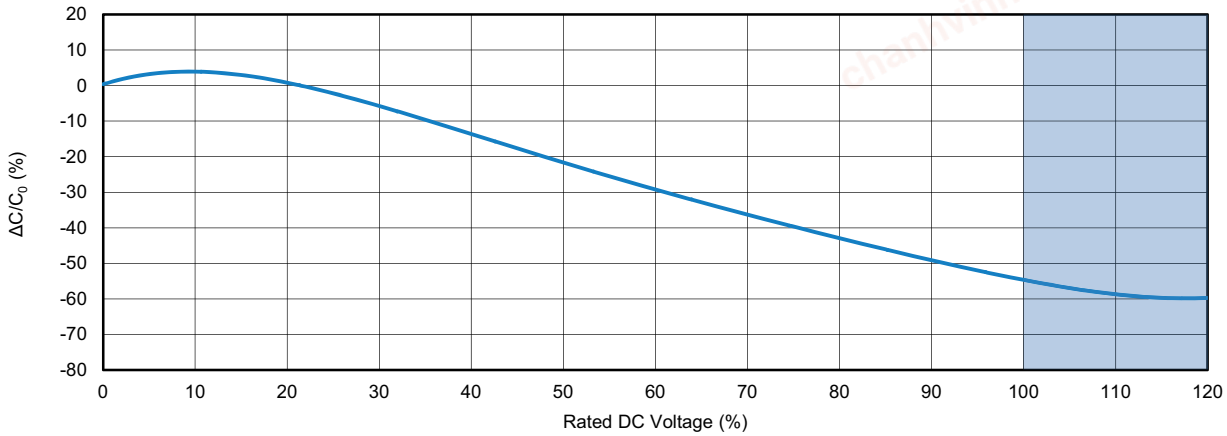
TYPICAL TCDF Y6P



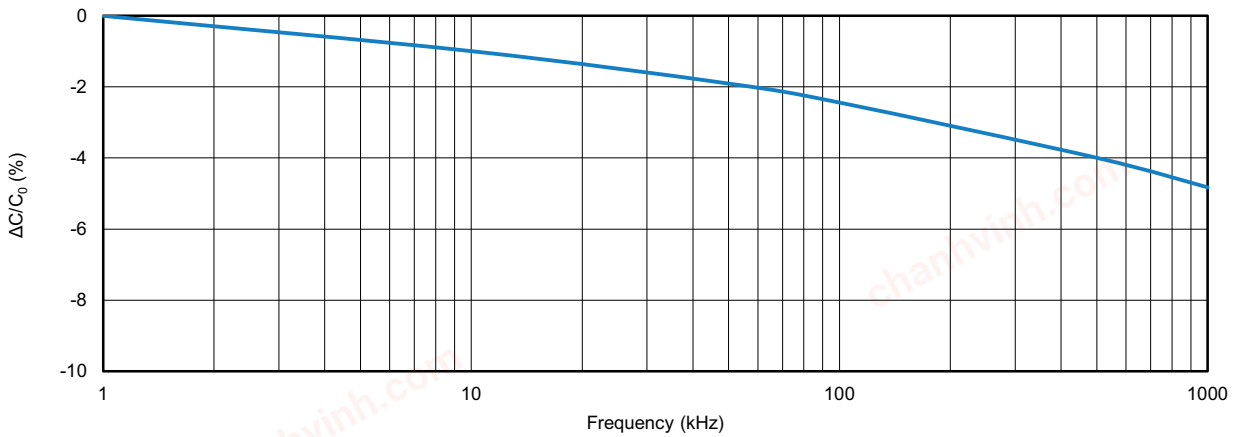
For technical questions, contact: slcap@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

chanhvinh.com

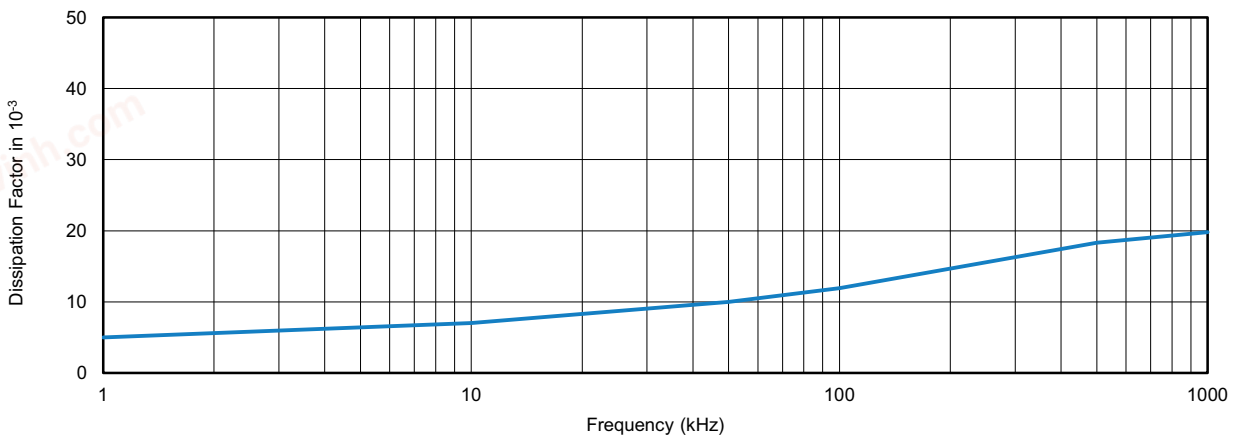
TYPICAL Y6P - $\Delta C/C_0$ / % VS. $U_{rated, DC}$



TYPICAL Y6P - $\Delta C/C_0$ / % VS. FREQUENCY



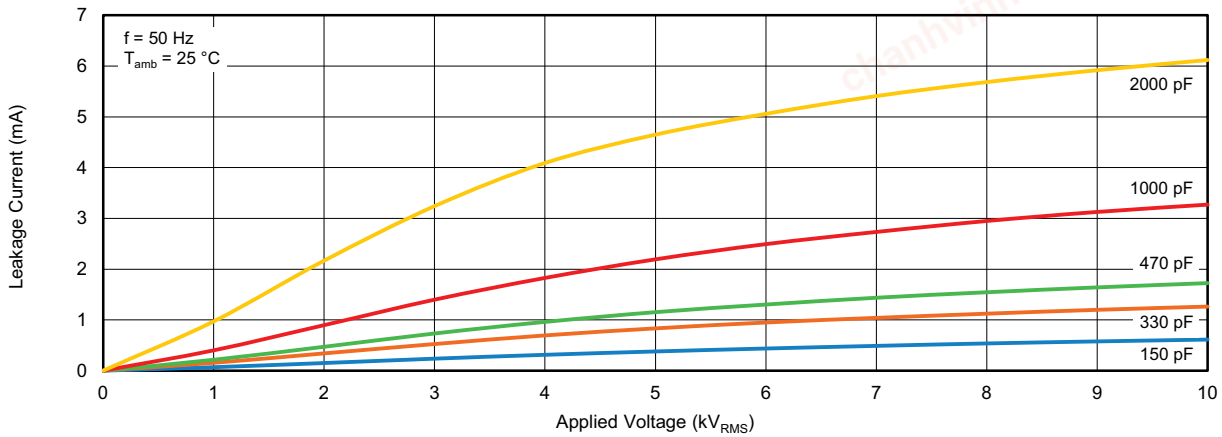
TYPICAL Y6P DF VS. FREQUENCY



For technical questions, contact: slcap@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

chanhvinh.com

TYPICAL Y6P AC CURRENT VS. APPLIED VOLTAGE (LEAKAGE CURRENT)



1. QUALIFICATION

1.1 BASICS

All components are tested according to the related testing plan, which you find in series datasheet. The test procedures are more severe than noted in the datasheet due to aging and storage effects of the components. We do not guarantee if any limit is exceeded. Internal test procedures are more severe than noted in the table “Performance” because of aging and storage effects of the components.

1.2 LIMITS OF APPLICATION

Please take care whilst designing our parts into one of these applications, which require highest reliability and possible errors might harm life, body or property of a third party.

- Transportation (aerospace, aircraft, train, ship, submarine, etc.)
- Medical equipment
- Critical control equipment (power plant, traffic signals, disaster prevention)
- Other application requiring similar reliability characteristics

2. STORAGE

2.1 ORIGINAL PACKAGING

Storing in the sealed original packages is preferred.

2.2 STORING CONDITIONS

Epoxy coating does not protect perfectly from all environmental conditions. Some materials can penetrate the epoxy and harm the performance of the parts. Therefore it is not recommended to use or store the parts in corrosive or humid atmosphere.

Optimal storing conditions should not exceed -10 °C to +40 °C and 15 % to 85 % relative humidity. When following these recommendations it is impossible, drying at 150 °C/60 min is recommended before assembly. If following this recommendation is not possible, drying the components at 150 °C/60 min is recommended before assembly.

3. ASSEMBLY

3.1 WIRE FORMING

If wire forming is needed, excessive mechanical force to the component body must be avoided as it might cause cracks in the ceramic element.

Do not crack coating extension of the epoxy layer, when applying force onto the wire.

For technical questions, contact: slcap@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

chanhvinh.com

3.2 SOLDERING

Do not exceed resistance to soldering heat specification of the component. Subjecting this product to excessive heating could melt the internal junction solder and may result in thermal shocks that can crack the ceramic element.

Manual Soldering / Rework

Set the soldering iron (50 W max.) to less than 400 °C and solder the wires within 4 seconds onto the PCB. Exceeding that recommendations might reduce the electrical performance of the component.

Wave Soldering

Most common way to assemble these kind of components is carried out in 4 steps:

1. Increasing temperature to 120 °C within about 20 s
2. Preheating at 120 °C for about 60 s
3. Soldering at 260 °C in less than 10 s
4. Gradual air cooling in constant air flow

Reflow Soldering

It is not recommended to use reflow soldering with these components.

3.3 MOLDING AND COATING

Molding and / or applying another coating material might harm the performance of the components. Therefore it is recommended to test the electrical characteristics of the molded / coated part in advance.

Typical error is a reduced withstand voltage because of an inadequate solvent in the molding material, which penetrates the epoxy coating. A similar result can be caused by an inadequate coating material, which might pull the original epoxy off the ceramic element.

4. CLEANING AND DRYING

4.1 CLEANING AGENTS

Cleaning agents might have an influence to the performance of the components after washing and after unsuitable drying. The following agents have been tested and classified:

Recommended

- DI water
- Isopropanol
- Ethanol
- Ehtyl alcohol
- ...

Not Recommended

- Acetone
- ...

4.2 ULTRASONIC

Settings for ultrasonic cleaning

Rinse bath capacity: output of 20 Watts per liter or less

Rinsing time: 5 min max.

Do not vibrate the PCB / PWB directly.

Excessive ultrasonic cleaning may lead to permanent destruction of the component.

4.3 DRYING

It is recommended to dry the assembled PCB (washed components) for 1 hour at a temperature of 20 °C higher than the boiling point of the used cleaning agent. Exceeding 150 °C permanently should be avoided.

5. TESTING AND OPERATION

5.1 SHORT CIRCUIT

Avoid repetitive zero-ohm-short circuits because they might harm the components core construction, such as arcs between lead wires because of inadequate insulation material (e.g air).

5.2 INSULATION

During operation, components should be surrounded by adequate insulating material (silicone oil, epoxy or molding material). Voltage breakdowns or leakage current through this material (between lead wires or to ground) is not acceptable.

5.3 APPLIED VOLTAGE

When using DC-rated components in AC applications (also ripple) the peak to peak voltage should not exceed the nominal DC-rating of the component.

For technical questions, contact: slcap@vishay.com

THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

chanhvinh.com

6. CAUTION

6.1 OPERATING VOLTAGE AND FREQUENCY CHARACTERISTIC

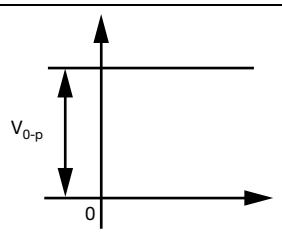
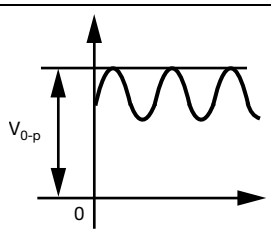
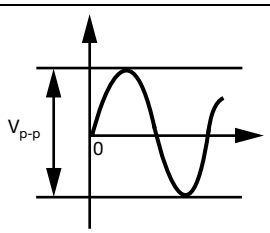
When sinusoidal or ripple voltage applied to DC ceramic disc capacitors, be sure to maintain the peak-to-peak value or the peak value of the sum of both AC + DC within the rated voltage.

When start or stop applying the voltage, resonance may generate irregular voltage.

When rectangular or pulse wave voltage is applied to DC ceramic disc capacitors, the self-heating generated by the capacitor is higher than the sinusoidal application with the same frequency. The allowable voltage rating for the rectangular or pulse wave corresponds approximately with the allowable voltage of a sinusoidal wave with the double fundamental frequency.

The allowable voltage varies, depending on the voltage and the waveform.

Diagrams of the limiting values are available for each capacitor series on request.

VOLTAGE	DC	DC + AC	AC
Waveform figure			

6.2 OPERATING TEMPERATURE AND SELF-GENERATED HEAT

The surface temperature of the capacitors must not exceed the upper limit of its rated operating temperature.

During operation in a high-frequency circuit or a pulse signal circuit, the capacitor itself generate heat due to dielectric losses.

Applied voltage should be the load such as self-generated heat is within 20 °C on the condition of environmental temperature 25 °C.

Note, that excessive heat may lead to deterioration of the capacitor's characteristics.

RELATED DOCUMENTS	
General Information	www.vishay.com/doc?22001
Product Sheet	www.vishay.com/doc?48508
Infographic	www.vishay.com/doc?48450

SAMPLE KIT	
Part Number	HVCC-KIT-HV
Link	www.vishay.com/doc?23147

For technical questions, contact: slcap@vishay.com
THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE. THE PRODUCTS DESCRIBED HEREIN AND THIS DOCUMENT ARE SUBJECT TO SPECIFIC DISCLAIMERS, SET FORTH AT www.vishay.com/doc?91000

chanhvinh.com

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.

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.

© 2019 VISHAY INTERTECHNOLOGY, INC. ALL RIGHTS RESERVED