



VISHAY INTERTECHNOLOGY, INC.

INTERACTIVE

data book

CERAMIC SINGLELAYER CAPACITORS

VISHAY DRALORIC

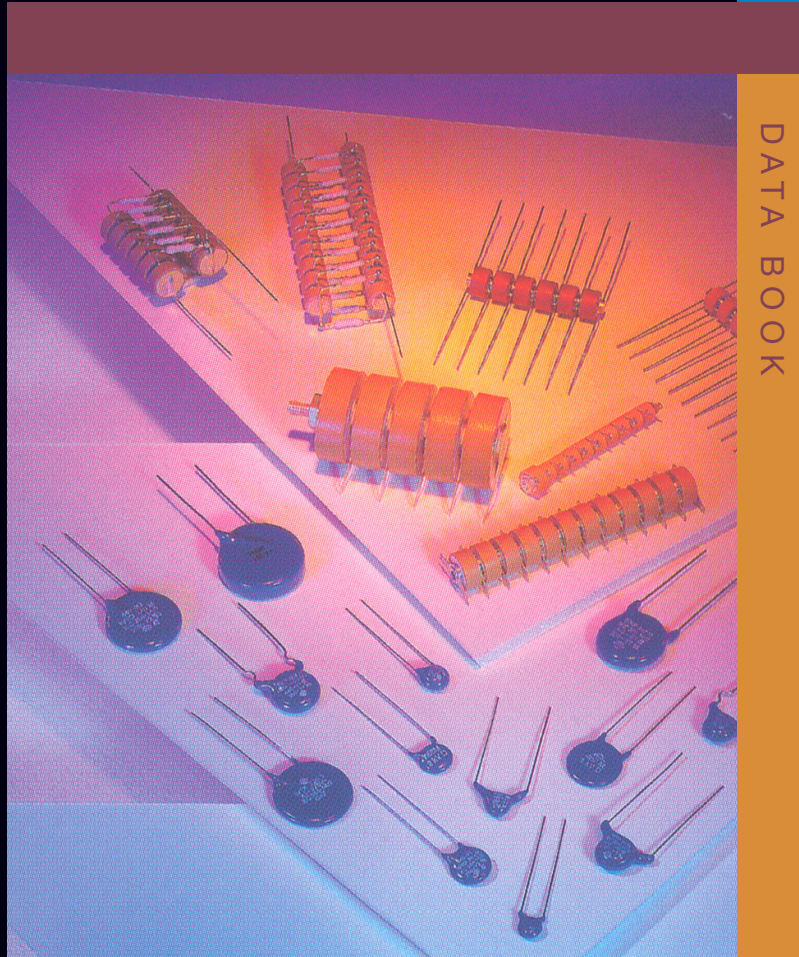
VSD-DB0012-0011

Notes:

1. To navigate:
 - a) Click on the Vishay logo on any datasheet to go to the Contents page for that section. Click on the Vishay logo on any Contents page to go to the main Table of Contents page.
 - b) Click on the products within the Table of Contents to go directly to the datasheet.
 - c) Use the scroll or page up/page down functions.
 - d) Use the Adobe® Acrobat® page function in the browser bar.
2. To search the text of the catalog use the Adobe® Acrobat® search function.



VISHAY INTERTECHNOLOGY, INC.



DATA BOOK

CERAMIC SINGLELAYER CAPACITORS

- Disc DC and AC Capacitors
- Ceramic Capacitor Stacks
- Tubular Capacitors
- Tubular Capacitor Sets
- Feed-Through Capacitors
- Feed-Through Filter Capacitors

SEMICONDUCTORS

RECTIFIERS

Schottky (single, dual)
 Standard, Fast, and Ultra-Fast Recovery
 (single, dual)
 Bridge
 Superectifier®
 Sinterglass Avalanche Diodes

HIGH-POWER DIODES AND THYRISTORS

High-Power Fast-Recovery Diodes
 Phase-Control Thyristors
 Fast Thyristors

SMALL-SIGNAL DIODES

Schottky and Switching (single, dual)
 Tuner/Capacitance (single, dual)
 Bandswitching
 PIN

ZENER AND SUPPRESSOR DIODES

Zener (single, dual)
 TVS (TRANSZORB®, Automotive, ESD, Arrays)

FETs

Low-Voltage TrenchFET® Power MOSFETs
 High-Voltage TrenchFET® Power MOSFETs
 High-Voltage Planar MOSFETs
 JFETs

OPTOELECTRONICS

IR Emitters and Detectors,
 and IR Receiver Modules
 Optocouplers and Solid-State Relays
 Optical Sensors
 LEDs and 7-Segment Displays
 Infrared Data Transceiver Modules
 Custom Products

ICs

Power ICs
 Analog Switches
 RF Transmitter and Receiver Modules
 ICs for Optoelectronics

MODULES

Power Modules (contain power diodes,
 thyristors, MOSFETs, IGBTs)
 DC/DC Converters

PASSIVE COMPONENTS

RESISTIVE PRODUCTS

Foil Resistors
 Film Resistors
 Metal Film Resistors
 Thin Film Resistors
 Thick Film Resistors
 Metal Oxide Film Resistors
 Carbon Film Resistors
 Wirewound Resistors
 Power Metal Strip® Resistors
 Chip Fuses
 Variable Resistors
 Cermet Variable Resistors
 Wirewound Variable Resistors
 Conductive Plastic Variable Resistors
 Networks/Arrays
 Non-Linear Resistors
 NTC Thermistors
 PTC Thermistors
 Varistors

MAGNETICS

Inductors
 Transformers

CAPACITORS

Tantalum Capacitors
 Molded Chip Tantalum Capacitors
 Coated Chip Tantalum Capacitors
 Solid Through-Hole Tantalum Capacitors
 Wet Tantalum Capacitors
 Ceramic Capacitors
 Multilayer Chip Capacitors
 Disc Capacitors
 Film Capacitors
 Power Capacitors
 Heavy-Current Capacitors
 Aluminum Capacitors
 Silicon RF Capacitors

STRAIN GAGE TRANSDUCERS AND STRESS ANALYSIS SYSTEMS

PhotoStress®
 Strain Gages
 Load Cells
 Force Transducers
 Instruments
 Weighing Systems
 Specialized Strain Gage Systems

Vishay Ceramic Singlelayer Capacitors

Vishay Electronic GMBH
Geheimrat-Rosenthal Strasse 100
D-95100 Selb
Germany
Phone: + 49 9287 710
Fax: + 49 9287 70435
www.vishay.com

Specifications are subject to change without notice.

The products listed in this catalog are not generally recommended for use in life support systems where a failure or malfunction of the component may directly threaten life or cause injury.

The user of products in such applications assumes all risks of such use and will agree to hold Vishay Intertechnology, Inc. and all the companies whose products are represented in this catalog, harmless against all damages.

All details in printed form are legally binding especially with respect to the provisions of §§463 and 480 II of the German Code of Civil Law after written confirmation only. The data indicated herein described the type of component and shall not be considered as assured characteristics.



Ceramic Singlelayer Capacitors

SECTION 1.	PAGE NUMBER:
CERAMIC DISC CAPACITORS WITH $U_R=500V_{DC}$... $25KV_{DC}$	
CERAMIC PULSE DISC CAPACITORS	
CERAMIC RFI AND SAFETY CAPACITORS	
General Information	2
Ceramic DC Disc Capacitors, Class 1 Ceramic Dielectric	22
Ceramic DC Disc Capacitors, Class 2 Ceramic Dielectric	26
Ceramic High Voltage Capacitors, Class 1 & Class 2 Ceramic Dielectric	28
Ceramic Pulse Disc Capacitors	34
Ceramic AC Disc Capacitors, Safety Standard Approved	42

SECTION 2.	
TUBULAR CERAMIC CAPACITORS	
General Information	56
Ceramic Tubular Capacitors Class 1 & Class 2	74
Tubular Capacitor Sets	81

SECTION 3.	
CERAMIC FEED-THROUGH & FILTER CAPACITORS	
General Information	84
Ceramic Feed-Through Capacitors	85
Ceramic Feed-Through Filters	91

SECTION 4.	
CERAMIC CAPACITOR STACKS & VOLTAGE MULTIPLIER SETS	
General Information	99
Ceramic Capacitors Stacks	100
Voltage Multiplier Sets	103

ALPHABETICAL PRODUCT INDEX	105
---	------------

Ceramic Disc, RFI and Safety Capacitors

In accordance with IEC recommendations ceramic capacitors are subdivided into two classes:

- CERAMIC CLASS 1 or low-K capacitors are mainly manufactured of titanium dioxide or magnesium silicate
- CERAMIC CLASS 2 or high-K capacitors contain mostly alkaline titanates

MAIN FEATURES		
	CLASS 1	CLASS 2
APPLICATION	For temperature compensation of frequency discriminating circuits and filters, coupling and decoupling in high-frequency circuits where low losses and narrow capacitance tolerances are demanded. As RFI and safety capacitors.	As coupling and decoupling capacitors for such application where higher losses and a reduced capacitance stability are required. As RFI and safety capacitors
PROPERTIES Temperature Dependence Capacitance	High stability of capacitance. Low dissipation factor up to higher frequencies. Defined temperature coefficient of capacitance, positive or negative, linear and reversible. High insulation resistance. No voltage dependence. High long-term stability of electrical values.	High capacitance values with small dimensions. Non-linear dependence of capacitance on temperature.
DC VOLTAGE CAPACITANCE DEPENDENCE	None	Increasing with ϵ
DISSIPATION FACTOR $\tan \delta$	max. $1.5 \cdot 10^{-3}$ (Typical)	max. $35 \cdot 10^{-3}$ (Typical)
INSULATION RESISTANCE	$\geq 10^{10}$ Ohm	$\geq 10^9$ Ohm
CAPACITANCE TOLERANCES	< 10pF: $\pm 0.25\text{pF}$, $\pm 0.5\text{pF}$, $\pm 1\text{pF}$ $\geq 10 \text{ pF}$: $\pm 2\%$, $\pm 5\%$, $\pm 10\%$, $\pm 20\%$	$\pm 10\%$, $\pm 20\%$, (+ 50 - 20)%, (+ 80 - 20)%
RATED VOLTAGE	Up to 25kV _{DC}	Up to 15kV _{DC}

STANDARDS AND SPECIFICATIONS	
GENERAL STANDARDS	
IEC 60062	Marking codes for resistors and capacitors
IEC 60068	Basic environmental testing procedures
Special Standards for Ceramic Capacitors	
EN 130600 and IEC 60384-8	Fixed capacitors of ceramic dielectric, class 1
EN 130700 and IEC 60384-9	Fixed capacitors of ceramic dielectric, class 2
Standards for Special Application Purposes	
CSA C22.2	RFI - and safety capacitors
EN 132400	
IEC 60065	
IEC 60384-14.2	
UL 1414	
VDE 0560, part 2'5.70 and VDE 0860/8.81	



MEASURING AND TESTING CONDITIONS		
	CLASS 1	CLASS 2
CAPACITANCE AND DISSIPATION FACTOR	$C \geq 1000\text{pF}$ 1kHz, 1 to $5V_{\text{RMS}}$ $C < 1000\text{pF}$ 1MHz, 1 to $5V_{\text{RMS}}$	$C \geq 100\text{pF}$ 1kHz, $1.0 \pm 0.2V_{\text{RMS}}$ $C < 100\text{pF}$ 1MHz, $1.0 \pm 0.2V_{\text{RMS}}$
INSULATION RESISTANCE	Rated voltage $< 100\text{V}$: $\geq 100\text{V}$ to $< 500\text{V}$: $\geq 500\text{V}$: Measuring time:	measuring voltage = $(10 \pm 1)\text{V}$ measuring voltage = $(100 \pm 15)\text{V}$ measuring voltage = $(500 \pm 50)\text{V}$ $60 \pm 5\text{s}$
DIELECTRIC STRENGTH	Rated voltage $\leq 500\text{V}$: Test voltage = $2.5 \cdot U_{\text{R}}$ $> 500\text{V}$: Test voltage = $1.5 \cdot U_{\text{R}}$ Testing time: 2s	

- Climatic test conditions: Temperature 20°C to 25°C
Relative humidity 50% to 70%

NOMINAL VALUE SERIES ACCORDING TO IEC 60063					
E 6	(± 20% TOLERANCE)	E 12	(± 10% TOLERANCE)	E 24	(± 5% TOLERANCE)
100			100		100
					110
			120		120
					130
150			150		150
					160
			180		180
					200
220			220		220
					240
			270		270
					300
330			330		330
					360
			390		390
					430
470			470		470
					510
			560		560
					620
680			680		680
					750
			820		820
					910

- Intermediate values available on request

General Information



Vishay Draloric

Ceramic Disc, RFI and Safety Capacitors

CAPACITANCE CODING SYSTEM			
CAPACITANCE VALUE	CODE	CAPACITANCE VALUE	
	p33	0.33pF	
	3p3	3.3pF	
	33p	33pF	
	330p	330pF	
	n33	330pF (0.33nF)	
	3n3	3300pF (3.3nF)	
	33n	33000pF (33nF)	
	330n	330000pF (330nF)	
	μ33	0.33μF	
3μ3	3.3μF		
CAPACITANCE TOLERANCE	CODE LETTER	C - TOLERANCE < 10PF: IN PF	C- TOLERANCE ≥ 10PF: IN %
	B	± 0.1	-
	C	± 0.25	-
	D	± 0.5	± 0.5
	F	± 1	± 1
	G	± 2	± 2
	H	-	± 2.5
	J	-	± 5
	K	-	± 10
	L	-	± 15
	M	-	± 20
	R	-	(+ 30 - 20)
S	-	(+ 50 - 20)	
Z	-	(+ 80 - 20)	
RATED VOLTAGE	Clear text		

CERAMIC DIELECTRIC	LETTER CODE	CERAMIC DIELECTRIC	CLASS 1 COLOUR CODE	LETTER CODE	CERAMIC DIELECTRIC	CLASS 2 COLOUR CODE
	A	P 100	red / violet	Z	K 2000	yellow
	C	NP 0	black	E	K 4000 / 5000	blue
	L	N 075	red	E	K 6000	none
	P	N 150	orange	X	K 10000	black
	R	N 220	yellow			
	S	N 330	green			
	T	N 470	blue			
	U	N 750	violet			
	V	N 1500	orange			
	K	N 2200	yellow / orange			
	-	N 4700	blue / orange			

The types of ceramic in bold print are standard versions, the colour coding is applied to the top edge of the capacitor.

• Note: The actual markings are given in detail on the respective data sheet.



PRODUCTION CODE ACC. TO IEC 60062

- The production code is indicated either with a 2 FIGURE CODE or with a 4 FIGURE CODE:

2 FIGURE CODE (YEAR / MONTH)

- The 1st figure indicates the year and the 2nd figure indicates the month.

YEAR	LETTER CODE
1990	A
1991	B
1992	C
1993	D
1994	E
1995	F
1996	H
1997	J
1998	K
1999	L
2000	M
2001	N
2002	P
2003	R
2004	S
2005	T
2006	U
2007	V
2008	W
2009	X
2010	A
2011	B
2012	C

MONTH	LETTER / NUMBER CODE
JANUARY	1
FEBRUARY	2
MARCH	3
APRIL	4
MAY	5
JUNE	6
JULY	7
AUGUST	8
SEPTEMBER	9
OCTOBER	O
NOVEMBER	N
DECEMBER	D

4 FIGURE CODE (YEAR / WEEK)

- The 1st two figures indicate the year and the second two figures indicate the week.

EXAMPLES:

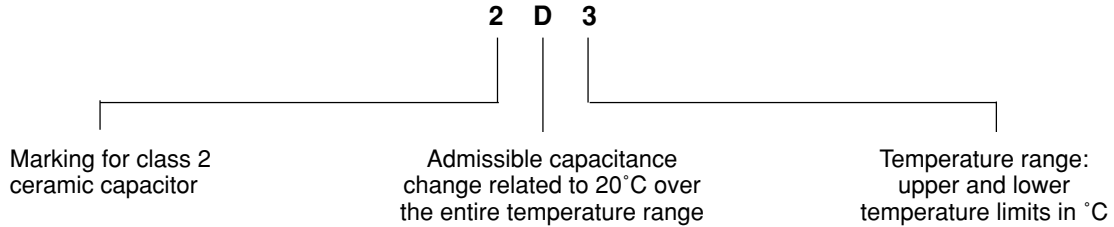
1998 NOVEMBER = KN
 1999 JULY = L7
 2000 AUGUST = M8
 2001 MAY = N5
 2002 OCTOBER = PO

EXAMPLES:

18th Week 1998 = 9818
 50th Week 1999 = 9950
 32nd Week 2000 = 0032
 41st Week 2001 = 0141
 27th Week 2002 = 0227

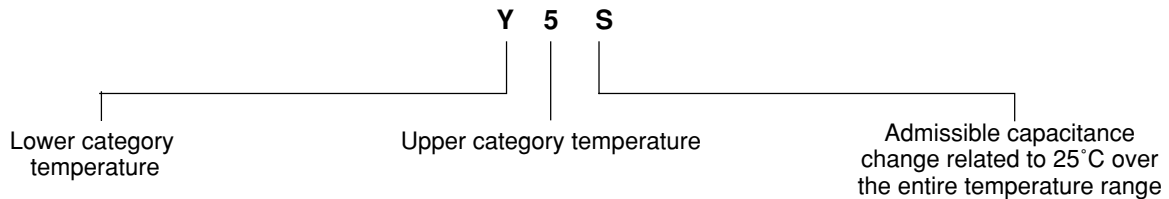
MARKING OF THE TEMPERATURE CHARACTERISTIC OF CAPACITANCE FOR CLASS 2 CERAMIC CAPACITORS

ACCORDING TO EN 130700 OR IEC 60384-9



DC VOLTAGE		CODE LETTER	TEMPERATURE RANGE	CODE FIGURE
WITHOUT	WITH			
± 10%	+ 10% / - 15%	B	- 55 to + 125	1
± 20%	+ 20% / - 30%	C	- 55 to + 85	2
+ 20% / - 30%	+ 20% / - 40%	D	- 40 to + 85	3
+ 22% / - 56%	+ 22% / - 70%	E	- 25 to + 85	4
+ 30% / - 80%	+ 30% / - 90%	F	- 10 to + 85	5
± 15%	+ 15% / - 40%	R		
± 15%	+ 15% / - 25%	X		

ACCORDING TO EIA STANDARD RS 198



TEMPERATURE	CODE LETTER
- 55°C	X
- 30°C	Y
+ 10°C	Z

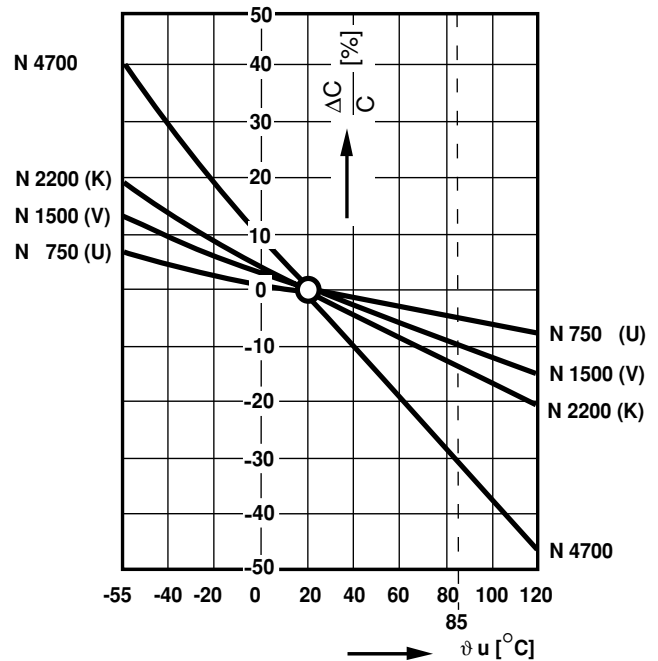
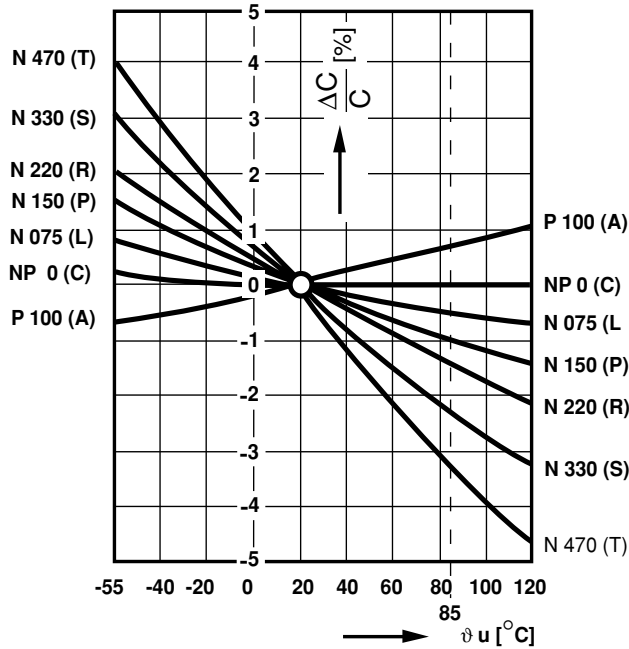
TEMPERATURE	CODE FIGURE
+ 45°C	2
+ 65°C	4
+ 85°C	5
+ 105°C	6
+ 125°C	7

CHANGE	CODE LETTER
± 1%	A
± 1.5%	B
± 2.2%	C
± 3.3%	D
± 4.7%	E
± 7.5%	F
± 10%	P
± 15%	R
± 22%	S
+ 22% / - 33%	T
+ 22% / - 56%	U
+ 22% / - 82%	V

CLASS 1 CERAMIC TYPE TEMPERATURE COEFFICIENT OF THE CAPACITANCE FOR CLASS 1 CERAMIC CAPACITORS

$$\frac{\Delta C}{C} [\%] = 100 \cdot \alpha \cdot \Delta \vartheta$$

ΔC = Capacitance change
 α = Temperature coefficient in $10^{-6}/^{\circ}\text{C}$
 $\Delta \vartheta$ = Temperature change in $^{\circ}\text{C}$



VOLTAGE DEPENDENCE OF CAPACITANCE

None

FREQUENCY DEPENDENCE OF CAPACITANCE

Max. - 2% at 10MHz

DISSIPATION FACTOR

- For values greater than 50pF: see data sheet
- For lower values the dissipation factor is calculated according to the type of ceramic (rated temperature coefficient) under consideration of the capacitance acc. to EN 130600

$$\begin{aligned}
 + 100 \leq \alpha < - 750: & \quad 1.5 \cdot \left(\frac{150}{C} + 7 \right) \cdot 10^{-4} \\
 - 750 \leq \alpha < - 1500: & \quad 2 \cdot \left(\frac{150}{C} + 7 \right) \cdot 10^{-4} \\
 - 1500 \leq \alpha < - 3300: & \quad 3 \cdot \left(\frac{150}{C} + 7 \right) \cdot 10^{-4} \\
 - 3300 \leq \alpha < - 5600: & \quad 4 \cdot \left(\frac{150}{C} + 7 \right) \cdot 10^{-4} \\
 \alpha \geq - 5600: & \quad 5 \cdot \left(\frac{150}{C} + 7 \right) \cdot 10^{-4}
 \end{aligned}$$

- The dissipation factor as well as the measuring method to be agreed between manufacturer and user for values lower than 5pF.



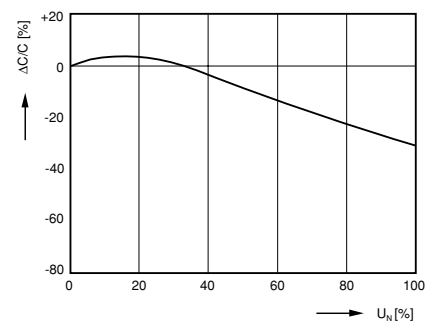
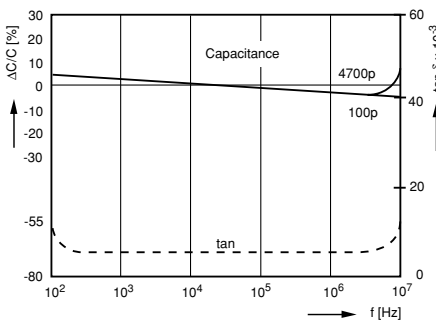
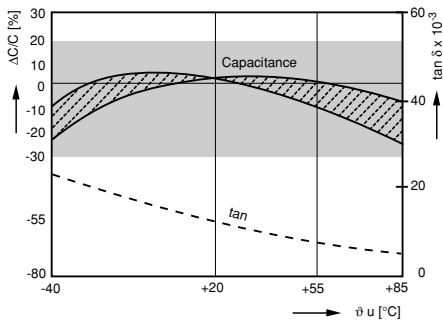
CLASS 2 CERAMIC TYPE

Capacitance Change and Dissipation Factor vs. Temperature

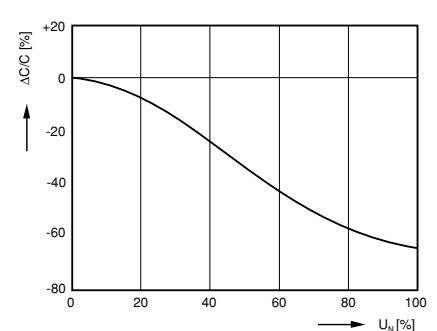
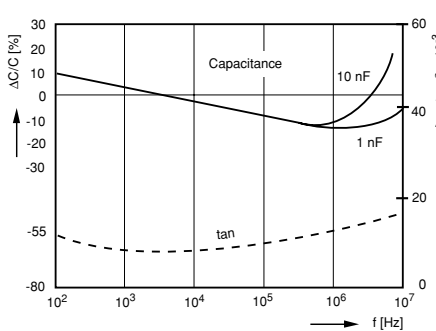
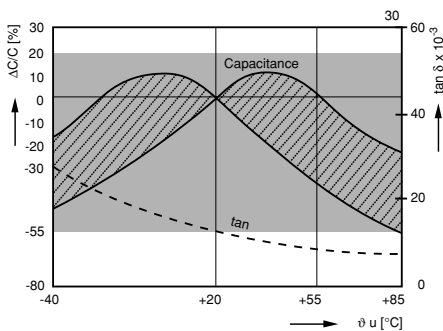
Capacitance Change and Dissipation Factor vs. Frequency

Capacitance Change vs. DC Voltage

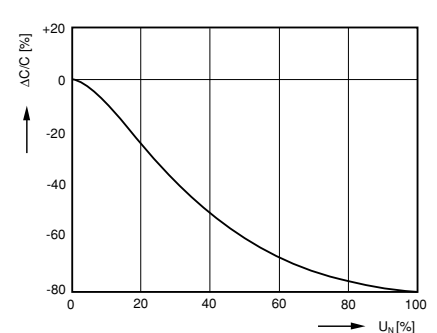
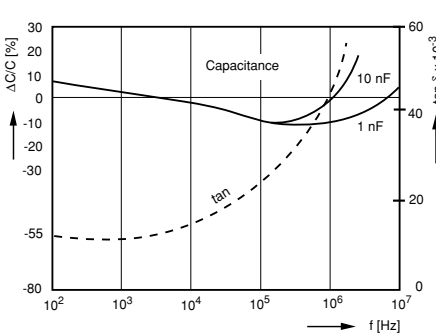
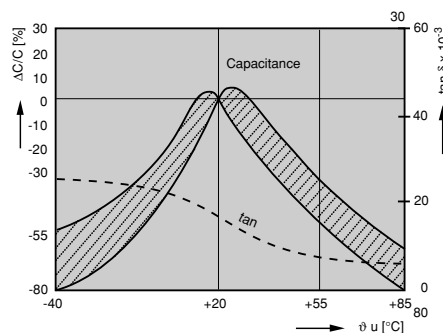
CERAMIC DIELECTRIC: 2D3 / K2000



CERAMIC DIELECTRIC: 2E3 / K4000 & K6000



CERAMIC DIELECTRIC: 2F3 / K10000





CAPACITANCE “AGEING” OF CERAMIC CAPACITORS

Following the final heat treatment all Class 2 Ceramic Capacitors reduce their capacitance value approximately according to logarithmic law due to their special crystalline construction. This change is called “ageing”. If the capacitors are heat treated, for example when soldering, the capacity increases again to a higher value and the ageing process begins again.

Note:

The level of this de-ageing is dependent on the temperature and the duration of the heat; an almost complete de-ageing is achieved at 150°C in one hour; these conditions also form the basis for reference measurements when testing. The capacitance change per time decade (ageing constant) differs for the various types of ceramic but typical values can be taken from the table below.

CERAMIC MATERIAL	K 2000	K 4000	K 6000	K 10000
AGEING CONSTANT k	- 4%	- 3%	- 4%	- 5%

$$k = \frac{100 \cdot (C_{t1} - C_{t2})}{C_{t1} \cdot \log_{10} (t1 / t2)}$$

t1, t2 = measuring time point (h)
 C_{t1}, C_{t2} = capacitance values for the times t1, t2
 k = ageing constant (%)

$$C_{t2} = C_{t1} \cdot (1 - k / 100 \cdot \log_{10} [t1 / t2])$$

REFERENCE MEASUREMENT:

Due to ageing it is necessary to quote an age for reference measurements which can be related to the capacitance with fixed tolerance. According to EN 130700 this time period is 1000 hours.

If the shelf-life of the capacitor is known, the capacitance for t = 1000h can be calculated with the ageing constant.

In order to avoid the influence of the ageing, it is important to de-age the capacitors before stress-testing. The following procedure is adopted (see also EN 130700) :

- De-ageing at 150°C, 1hour
- Storage for 24 hours at normal climate temperature
- Initial measurement
- Stress
- De-ageing at 150°C, 1hour
- Storage for 24 hours at normal climate temperature
- Final measurement

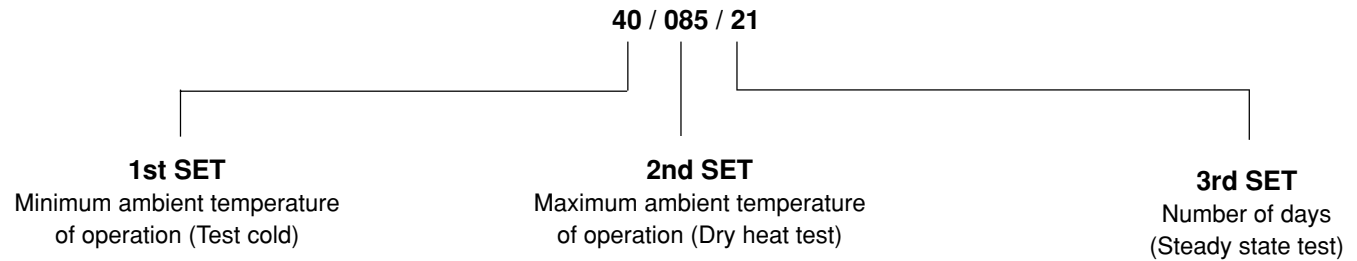
General Information

Vishay Draloric

Ceramic Disc, RFI and Safety Capacitors



COMPONENT CLIMATIC CATEGORY



The large number of possible combinations of tests and severities may be reduced by the selection of a few standard groupings according to IEC 60068-1

CATEGORY EXAMPLES ACC. TO IEC 60068-1

25 / 085 / 04
25 / 085 / 21
40 / 085 / 21
55 / 125 / 21
55 / 125 / 56

First set: Two digits denoting the minimum ambient temperature of operation (Cold test)

65	- 65°C
55	- 55°C
40	- 40°C
25	- 25°C
10	- 10°C
00	0°C
05	+ 5°C

Second set: Three digits denoting the maximum ambient temperature (Dry heat test)

155	+ 155°C
125	+ 125°C
110	+ 110°C
090	+ 90°C
085	+ 85°C
080	+ 80°C
075	+ 75°C
070	+ 70°C
065	+ 65°C
060	+ 60°C
055	+ 55°C

Third set: Two digits denoting the number of days of the damp heat steady state test (Ca)

56	56 days
21	21 days
10	10 days
04	04 days
00	The component is not required to be exposed to damp heat



STORAGE

The capacitors must not be stored in a corrosive atmosphere, where sulphide or chloride gas, acid, alkali or salt are present. Exposure of the components to moisture, should be avoided. The solderability of the leads is not affected by storage of up to 24 months (temperature + 10°C to + 35°C, relative humidity up to 60%RH). Class 2 Ceramic Dielectric Capacitors are also subject to ageing see previous page.

SOLDERING

SOLDERING SPECIFICATIONS		
Soldering test for capacitors with wire leads: (according to IEC 60068-2-20, solder bath method)		
	SOLDERABILITY	RESISTANCE TO SOLDERING HEAT
Soldering Temperature	(235 ± 5) °C	(260 ± 5) °C
Soldering Duration	(2 ± 0.5) sec	(10 ± 1) sec
Distance from Component Body	≥ 2mm	≥ 5mm

SOLDERING RECOMMENDATIONS

Soldering of the component should be achieved using a SN60/40 type or a silver-bearing SN62/36/2AG type solder. Ceramic capacitors are very sensitive to rapid changes in temperature (Thermal shock) therefore the solder heat resistance specification (see above table) should not be exceeded. Subjecting the capacitor to excessive heating may result in thermal shocks that can crack the ceramic body. Similarly, excessive heating can cause the internal solder junction to melt.

CLEANING

The components should be cleaned immediately following the soldering operation with vapor degreasers.

SOLVENT RESISTANCE

The coating and marking of the capacitors are resistant to the following test method:

IEC 60068-2-45 (Method XA)

MOUNTING

We do not recommend modifying the lead terminals, e.g. bending or cropping. This action could break the coating or crack the ceramic insert. If however, the lead must be modified in any way, we recommend support of the lead with a clamping fixture next to the coating.

AQL / FIT VALUES / SUPPLIED QUALITY

AQL 0.1 FOR THE SUM OF THE ELECTRIC MAIN FAULTS

- C - Tolerance > 1.5 x Tolerance Limit
- DF > 1.5 x Catalog Value
- R_{IS} < Catalog Value
- Inadequate Dielectric Breakdown
- Interruption

AQL 0.25 FOR THE SUM OF THE MECHANICAL MAIN FAULTS

- Marking wrong or missing
- Dimensions out of Tolerance
- Coating Failure
- Lead Space out of Tolerance
- Poor Solderability of Leads
- Wrong Lead Length

AQL 0.65 FOR SECONDARY FAULTS

- Coating Extension out of Tolerance
- Marking Incomplete
- Tape Dimensions out of Tolerance

Testing in accordance to IEC60410

NOTE:

The following agreements are possible on request:

- Lower AQL values
- Confirmed Initial random sampling test with appropriate report
- Report on production test findings
- Agreement on ppm concept

RELIABILITY

By careful control of the manufacturing process stages, the quality of the product is maintained at the highest possible level. To obtain data on the reliability of our ceramic capacitors, many long-term tests under increased temperature and voltage conditions have been carried out in our laboratories.

Based on the results of these tests, the following can be stated:

Reference Conditions:	Ambient Temperature:	$(40 \pm 2)^{\circ}\text{C}$
	Relative Humidity:	$(60 \pm 2)\%$
	Electrical Stress:	50% Rated Voltage (U_R)

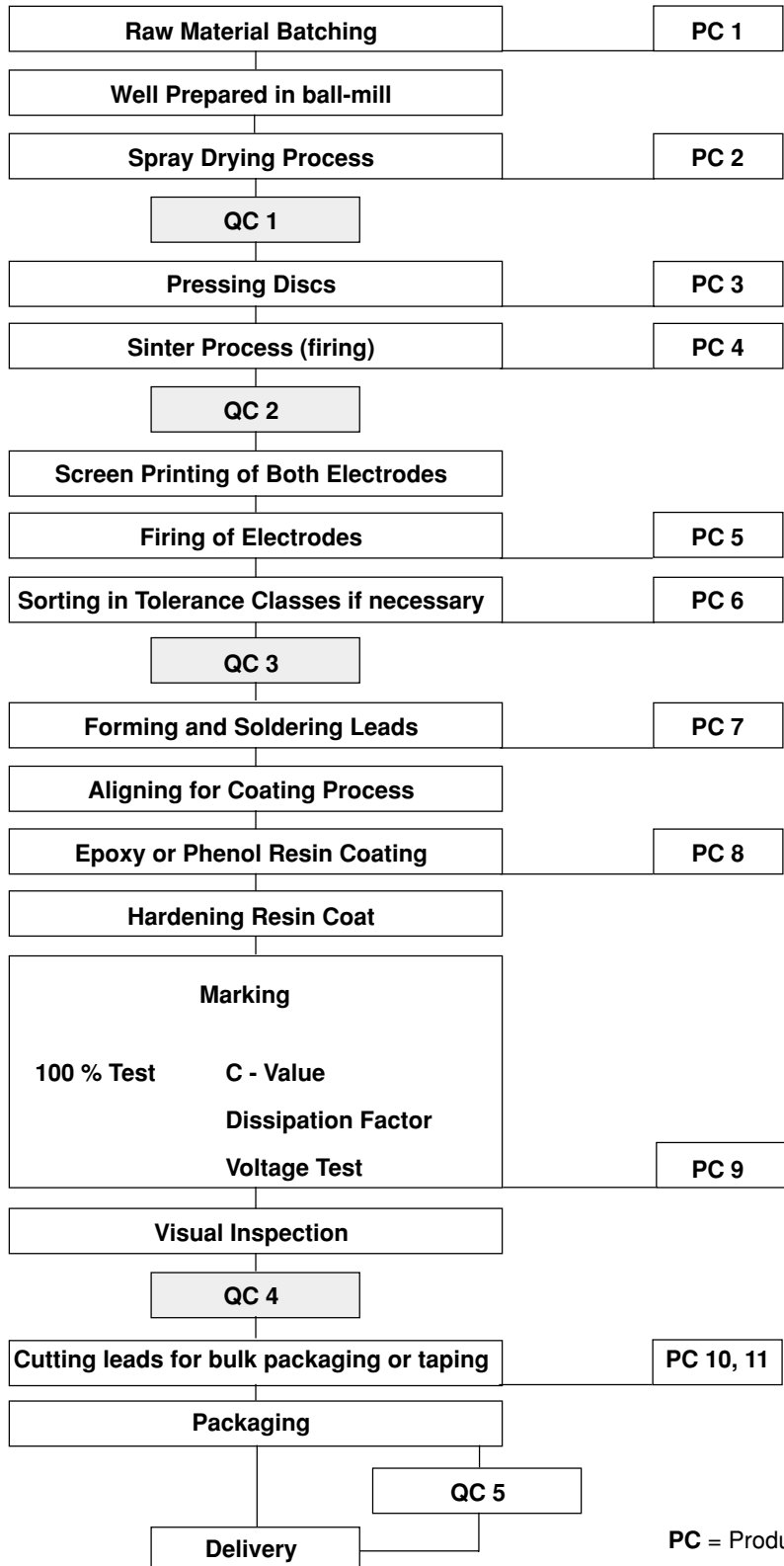
Failure Criteria:	Short Circuit ($R \leq 10^{-5}\Omega$) or open circuit	
Failure Tests:	Class 1 Capacitors:	$\lambda = 2 \times 10^{-9}\text{h}^{-1}$
	Class 2 Capacitors:	$\lambda = 5 \times 10^{-9}\text{h}^{-1}$

By derating the voltage load, greatly increased reliability can be predicted.

Temperature, up to the maximum category temperature, is not believed to significantly affect the reliability.



PRODUCTION FLOWCHART



PC = Production Control
QC = Quality Control

General Information

Vishay Draloric

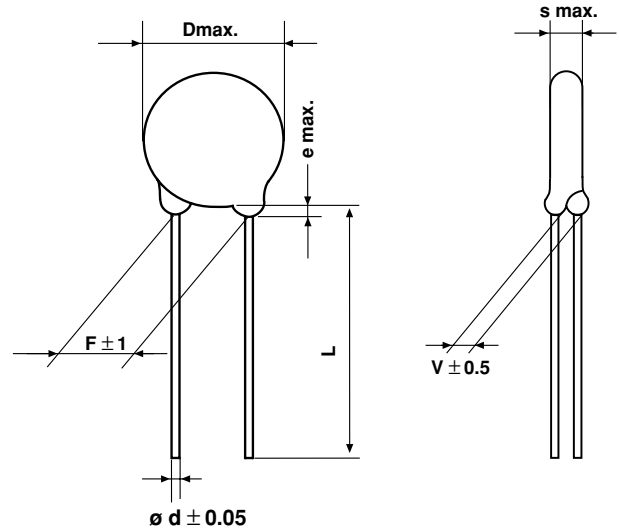
Ceramic Disc, RFI and Safety Capacitors



AVAILABLE STANDARD LEAD CONFIGURATIONS

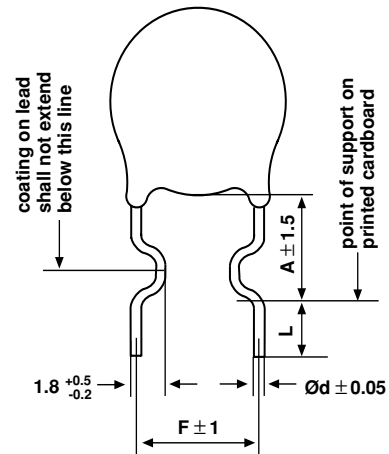
FORM 1 - STRAIGHT LEADS, LONG OR SHORT

$\varnothing d$	0.6 or 0.8			
L	30 - 3 or 10 ± 1			
F	5	7.5	10	12.5
e	max. 3.0mm			



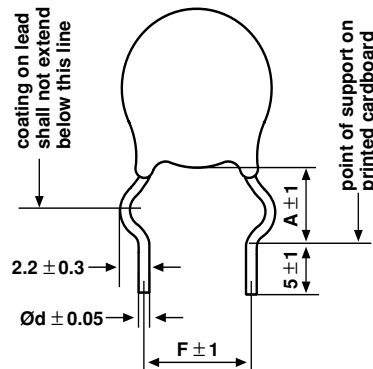
FORM 2 - PREFORMED LEADS (INSIDE CRIMP)

$\varnothing d$	0.6 or 0.8			
F	5	7.5	10	12.5
A	$4.0 -1 + 0.5$	4.0 ± 1.5	5.0 ± 1.5	6.0 ± 1.5
L	min. 3.0mm			
Tolerance: 1.0mm absolute				



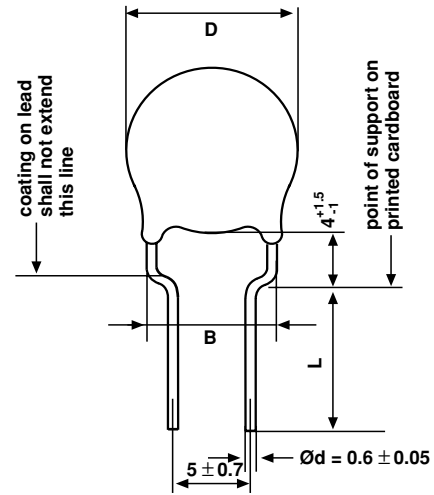
FORM 3 - PREFORMED LEADS (OUTSIDE CRIMP)

$\varnothing d$	0.6	0.8	0.6 or 0.8		
F	5.0	7.5	7.5	10	12.5
A	5.0	5.0	6.0	6.0	6.0



FORM 4 - PREFORMED LEADS (7.5 TO 5MM)

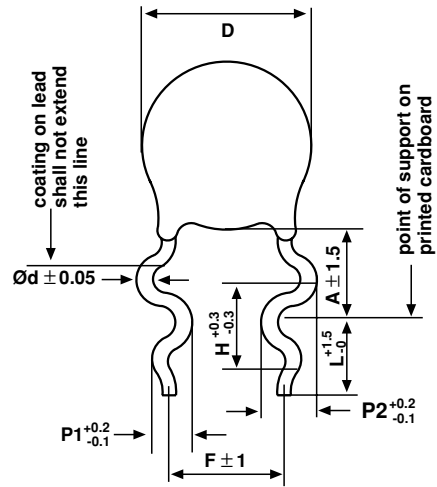
Ød	0.6
B	D ≤ 9: 6.8 ± 0.7 D > 9: 7.5 ± 0.7
L	min. 2mm
	Tolerance 2mm absolute



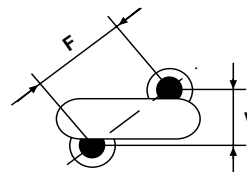
FORM 5 - PREFORMED LEADS (DOUBLE CRIMP 'SNAP IN')

Ød	0.6	0.8
F	5.0 / 7.5 / 10 / 12.5	7.5 / 10 / 12.5
L	min. 2.8mm	min. 3.5mm
H	2.6	3.3
P1	1.25	1.65
P2	1.65	1.95
A	D ≤ 8: 6.0 ± 1.5 D > 8: 7.0 ± 1.5	

General Information: PCB max. thickness 1.6mm



Measurement position of Lead Spacing F and Width V

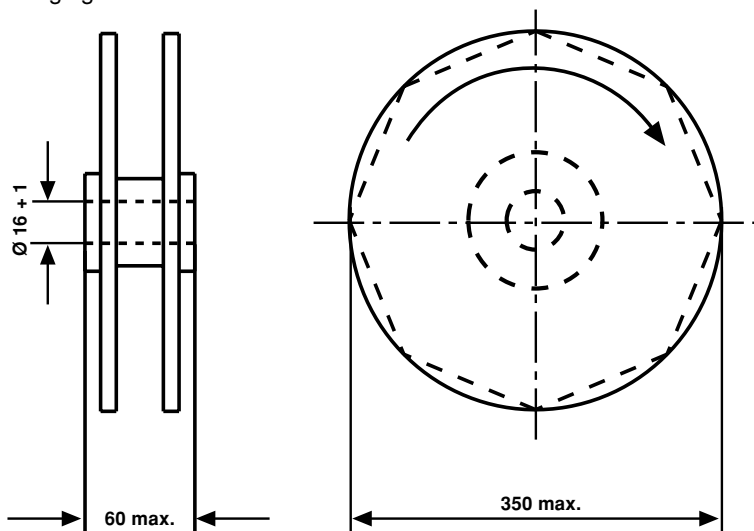


RADIAL TAPING OF CERAMIC DISC CAPACITORS

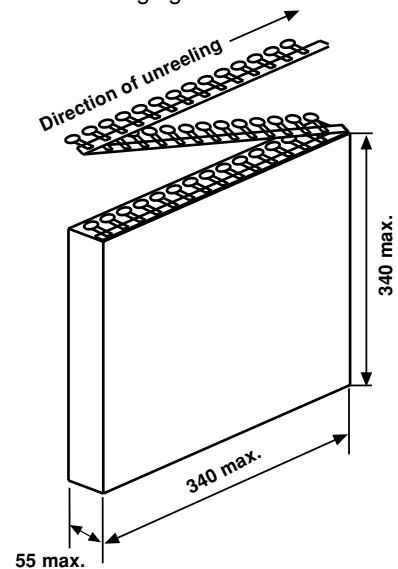
DESIGNATION	SYMBOL	TAPING P	TAPING T	TAPING U	TAPING F
Pitch of Component	P		12.7 ± 1		25.4 ± 1
Pitch of sprocket hole	P ₀		12.7 ± 0.3		12.7 ± 0.3
Distance, hole to lead	P ₁		3.85 ± 0.7		(0.5F) ± 0.7
Distance, hole to center of component	P ₂		6.35 ± 1.3		12.7 ± 1.3
Lead spacing	F		5.0 / 7.5 + 0.8 - 0.2		5/7.5/10/12.5 ± 0.8
Average deviation across tape	Δh		± 2.0 max.		± 3.0 max.
Average deviation in direction of reeling	ΔP		± 1.3 max.		± 1.3 max.
Carrier tape width	W		18.0 + 1 - 0.5		18.0 + 1 - 0.5
Hold-down tape width	W ₀		6.0		6.0
Position of sprocket hole	W ₁		9.0 + 0.75 - 0.5		9.0 + 0.75 - 0.5
Distance of hold-down tape	W ₂		3.0 max.		3.0 max.
Distance between the abscissa and the bottom plane of the component body	H	16.5 ± 0.5	18.0 + 2 - 0	20 ± 1	16.5 ± 0.5 18.0 + 2 - 0 20.0 ± 1
Distance between the abscissa and the reference plane of the component with crimped leads.	H ₀		16.0 ± 0.5		16.0 ± 0.5
Length of cut leads	L		11.0 max.		11.0 max.
Diameter of sprocket hole	D ₀		4.0 ± 0.2		4.0 ± 0.2
Total tape thickness	t		0.9 max.		0.9 max.

PACKAGING VERSIONS

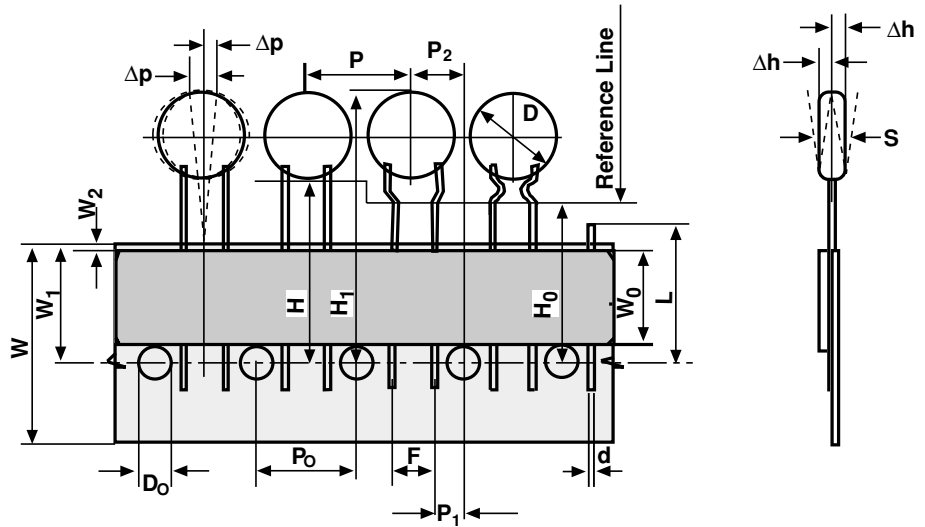
Reel Packaging



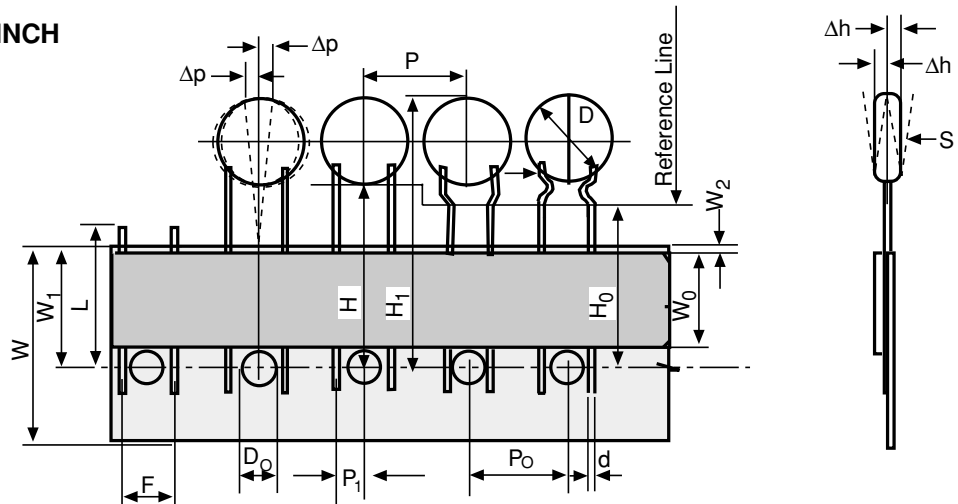
Ammo Packaging



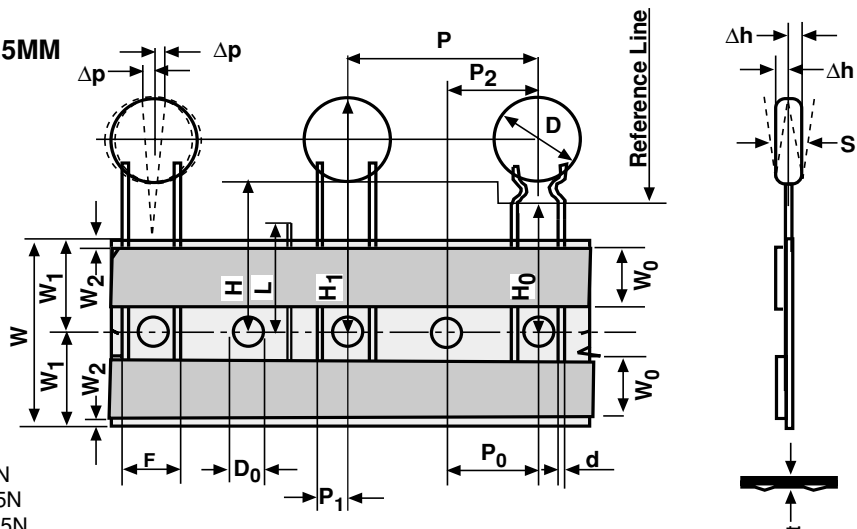
TAPING P / T / U
COMPONENT PITCH 0.5 INCH
LEAD SPACING 5.0MM



TAPING P / T / U
COMPONENT PITCH 0.5 INCH
LEAD SPACING 7.5MM



TAPING F
COMPONENT PITCH 1.0 INCH
LEAD SPACING 5.0 / 7.5 / 10 / 12.5MM



- Pulling force from the tape $\geq 5N$
- Tensile strength of tape $\geq 15N$
- Unreeling force of tape from reel $\geq 2.5N$

Maximum 0.5% of all components on reel may be missing. A maximum of 3 consecutive components may be missing provided this gap is followed by 6 consecutive components. The splices shall have the same minimum strength as the tape. The splices must be not thicker than 1.5mm, the sprocket holes may not be effected.

General Information



Vishay Draloric

Ceramic Disc, RFI and Safety Capacitors

The ordering code is made up of a 13-digit code.

ORDERING INFORMATION					
Example: HAZ	102	M	BA	BF0	K
1 2 3	4 5 6	7	8 9	10 11 12	13
CAPACITOR SERIES	CAPACITANCE VALUE IN pF	TOLERANCE	RATED VOLTAGE	DESIGN	INTERNAL CODE
To be taken from the respective individual data sheet	<u>1st Two Digits</u> represent significant figures <u>3rd Digit</u> is the multiplier (x10) e.g. 1.6pF = 916 10pF = 100 120pF = 121 4700pF = 472 22nF = 223	C = $\pm 0.25\text{pF}$ D = $\pm 0.5\text{pF}$ J = $\pm 5\%$ K = $\pm 10\%$ M = $\pm 20\%$ S = + 50 - 20% Z = + 80 - 20%	AQ = 500V- BA = 1kV- BB = 2kV- BC = 3kV BD = 4kV- BE = 5kV- BF = 6kV- BP = 8kV- BH = 10kV- BJ = 15kV- BQ = 25kV- CM = 250 / 440V~ CV = 275V~ CP = 440V~ CQ = 440V~	STRAIGHT LEADS OR INSIDE CRIMP. <u>10th digit</u> LEAD SPACING B = 5.0mm C = 7.5mm D = 10mm E = 12.5mm <u>11th Digit*</u> LEAD LENGTH / DIA B = 6 + 0.1 / 0.6 D = 10 \pm 1 / 0.6 H = 10 \pm 1 / 0.8 Y = ≥ 20 / 0.6 F = 30 - 3 / 0.6 J = 30 - 3 / 0.8 S = ≥ 30 / 0.6 P = 45 \pm 2 / 0.6 R = Taping & Reeling L = Taping & Ammo <u>12th Digit *</u> 0 = Bulk Other = Special type OTHER LEAD CONFIGURATION: <u>10th digit</u> Q = Snap-In T = Outside crimp U = 7.5 to 5mm SPECIALITY <u>10th digit</u> R or S	

*The schematic of the 11th and 12th digit is only applicable if the 10th digit is B, C, D or E



ORDER CODE, 10, 11 AND 12 DIGIT

BULK PACKAGING						
	LEAD LENGTH L	LEAD DIA d	LEAD SPACING F			
			5mm	7.5mm	10mm	12.5mm
STRAIGHT LEADS	30 - 3mm	0.6mm	BF0	CF0	DF0	EF0
		0.8mm	BJ0	CJ0	DJ0	EJ0
	25 + 5mm	0.6mm	BY0	CY0	---	---
	10 ± 1mm	0.6mm	BD0	CD0	DD0	ED0
		0.8mm	BH0	CH0	DH0	EH0
6.0 + 0 - 1mm	0.6 / 0.8mm	BB0	CB0	DB0	EB0	
PREFORMED LEADS INSIDE CRIMP	30 - 3mm	0.6mm	BFG	CFG	DFG	EFG
		0.8mm	---	CJG	DJG	EJG
PREFORMED LEADS OUTSIDE CRIMP	5.0 ± 1mm	0.6mm	TA0	TC0	TE0	TG0
		0.8mm	---	TD0	TF0	TH0
PREFORMED LEADS SNAP-IN	min. 2.8mm	0.6mm	QA0	QC0	QE0	QG0
	min. 3.5mm	0.8mm	---	QD0	QF0	QH0

REEL PACKAGING						
COMPONENT PITCH 12.7mm LEAD DIAMETER 0.6mm	TAPING P H = 16.5		TAPING T H = 18.0mm / H ₀ = 16.0mm		TAPING U H = 20.0mm	
LEAD SPACING F	5mm	7.5mm	5mm	7.5mm	5mm	7.5mm
BODY DIAMETER D	valid for ≤ 12mm STANDARD (> 12mm to ≤ 13mm on request)					
STRAIGHT LEADS	BRE	CRE	BRA	CRA	BRC	CRC
PREFORMED LEADS INSIDE CRIMP	---	---	BRB	CRB		
PREFORMED LEADS OUTSIDE CRIMP	---	---	TAR	TCR	---	---
PREFORMED LEADS 7.5mm to 5mm	---	---	UAR	---	---	---
PREFORMED LEADS SNAP-IN	---	---	QAR	QCR	---	---

REEL PACKAGING						
COMPONENT PITCH 25.4mm	TAPING F					
LEAD SPACING F			5mm	7.5mm	10mm	12.5mm
BODY DIAMETER D			> 12mm		ALL DIAMETERS	
STRAIGHT LEADS	H = 16.5mm		BRT	CRT	DRT	ERT
	H = 18.0mm		BRU	CRU	DRU	ERU
	H = 20.0mm		BRY	CRY	DRY	ERY
PREFORMED LEADS INSIDE CRIMP	H ₀ = 16.0mm		BRZ	CRZ	DRZ	ERZ

• The lead diameter of the taped components depends on the capacitance value and corresponds with the data given in the individual data sheets.

AMMO PACKAGING						
COMPONENT PITCH 12.7mm	TAPING P H = 16.5		TAPING T H = 18.0 / H ₀ = 16.0		TAPING U H = 20.0	
LEAD SPACING F	5mm	7.5mm	5mm	7.5mm	5mm	7.5mm
DISC DIAMETER D	Valid for ≤ 12mm STANDARD (> 12mm to ≤ 13mm on request)					
STRAIGHT LEADS	BLE	---	BLA	CLA	BLC	---
PREFORMED LEADS INSIDE CRIMP	---	---	BLB	---	---	---
PREFORMED LEADS 7.5mm to 5mm	---	---	UAL	---	---	---

Quality Certificate

Vishay Draloric



ISO 9001

Within the scope of our efforts to meet the internationally growing quality requirements, the facility for ceramic capacitors in Schierling is certified according to ISO 9001.

HARMONIZED SYSTEM OF QUALITY ASSESSMENT FOR ELECTRONIC COMPONENTS CECC		ECQAC
CERTIFICATE OF APPROVAL OF MANUFACTURER DIN EN 100 114 PART I		
REGISTRATION NUMBER:	492010.95 (AK)	
MANUFACTURER:	VISHAY ELECTRONIC GMBH, Geschäftsbereich DRALORIC, D-89100 Seib	
AT THEIR PLACES OF WORK:	Straubinger Strasse 37, D-84068 Mallersdorf-Plattfening Vishay Electronic spol. s.r.o., CZ-35604 Dolní Křečovice	
IN RESPECT OF GENERIC/SECTIONAL SPECIFICATION:	CECC 30 600 CECC 30 700	Fixed capacitors of ceramic dielectric, Class 1 Fixed capacitors of ceramic dielectric, Class 2
<p>THE ORGANIZATION, FACILITIES AND INSPECTION PROCEDURES AT THE ABOVE PLACE OF WORK HAVE BEEN FOUND TO COMPLY WITH THE REQUIREMENTS OF THE RULES OF THE CONSUMER ELECTRONIC COMPONENTS COMMITTEE (CECC) AND IN PARTICULAR OF DOCUMENT DIN EN 100 114 PART I AND DIN EN ISO 9001:1994 FOR QUALITY ASSESSMENT IN RESPECT OF THE FAMILIES OF COMPONENTS LISTED IN THE APPROVAL DOCUMENT(S). THIS CERTIFICATE DOES NOT AUTOMATICALLY ENTITLE THE MANUFACTURER TO USE THE MARK OR CERTIFICATE OF CONFORMITY. THE APPROVAL OF ANY PARTICULAR TYPE OF ELECTRONIC COMPONENT IS THE SUBJECT OF A SEPARATE CERTIFICATE.</p> <p style="text-align: center;">THIS APPROVAL CERTIFICATE ALSO COVERS ALL REQUIREMENTS OF DIN EN ISO 9001:1994</p>		
CECC CONSUMER ELECTRONIC COMPONENTS COMMITTEE ECQAC Electronic Components Quality Assurance Committee	<p>NOTE: This certificate is valid only in conjunction with the approval document(s).</p> <p>This approval and this certificate may be suspended or withdrawn in accordance with the Rules of CECC/ISO/Consumer Components Committee (CECC).</p> <p>This certificate remains the property of the body which granted it.</p> <p>This approval is valid until 2001-11-04.</p>	<p>IOE ASSOCIATION FOR ELECTRICAL, ELECTRONIC & INFORMATION TECHNOLOGIES VDE TESTING AND CERTIFICATION INSTITUTE AS THE NATIONAL SUPERISING SUPERSTORY</p> <p>D-53355 OPPENBACH DATE: 2001-01-08</p> <p><i>Bequweller</i></p>

VDE Prüf- und Zertifizierungsinstitut

VDE VERBAND DER ELEKTROTECHNIK
ELEKTROH. INFORMATIONSTECHNIK e.V.

CERTIFICATE

Registration Number 4920/GM/10.95 (AK, AM)

This is to certify that the company

VISHAY ELECTRONIC GMBH
Geschäftsbereich DRALORIC

in the following locations

Straubinger Strasse 37, D-84068 Mallersdorf-Plattfening
Vishay Electronic spol. s.r.o.,
Zavod Dolní Křečovice
Bengasova 394
CZ-35604 Dolní Křečovice

has implemented and maintains a
Quality System for the following scope

Fixed capacitors of ceramic dielectric
Class 1 and Class 2

This Q System complies with the requirements of

DIN EN ISO 9001:1994

This Certificate is valid until 2001-11-04

VDE Testing and Certification Institute
Certification



D-53369 Oppenbach/Main, Meranostraße 25
Date: 1999-12-15

The VDE Testing and Certification Institute is accredited by BAM according to DIN EN ISO 9001 and additional under DIN EN ISO 9004.





DC Disc Capacitors with $U_R = 500V_{DC}$ to $25kV_{DC}$

SERIES	DESIGN	U_R	CAPACITANCE RANGE	PAGE
RLA RLC RLP RLU RLV RLK	Disc Capacitors Class 1 Ceramic Dielectric	$500V_{DC}$	1pF to 100pF	22
HSE HSZ	Disc Capacitors Class 2 Ceramic Dielectric	$500V_{DC}$	10pF to 0.010 μ F	26
HAU HBU HCU HDU HEU HFU	High Voltage Disc Capacitors Class 1 Ceramic Dielectric	$1kV_{DC}$ to $6kV_{DC}$	10pF to 680pF	28
HAE HAX HAZ HBE HBX HBZ HCE HCX HCZ HDE HEE HFE HFZ HGZ HHZ HIZ	High Voltage Disc Capacitors Class 2 Ceramic Dielectric	$1kV_{DC}$ to $15kV_{DC}$	33pF to 0.022 μ F	30
HAK HBK HCK HIK IBC IEL	Pulse Disc Capacitors Class 1 & Class 2 Ceramic Dielectric	$1kV_{DC}$ to $25kV_{DC}$	33pF to 4700pF	34

Ceramic Disc Capacitors, Class 1

DESIGN:

Disc capacitors with phenol resin coating

RATED VOLTAGE U_R :

500V_{DC}

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test
1250V_{DC} 2s

DISSIPATION FACTOR $\tan \delta$:

$$C < 30\text{pF} : \leq \left(\frac{100}{C} + 7\right) \cdot 10^{-4}$$

$$C \geq 30\text{pF} : \leq 10 \cdot 10^{-4}$$

INSULATION RESISTANCE R_{IS} :

$$\geq 1 \cdot 10^{10}\Omega$$

MARKING:

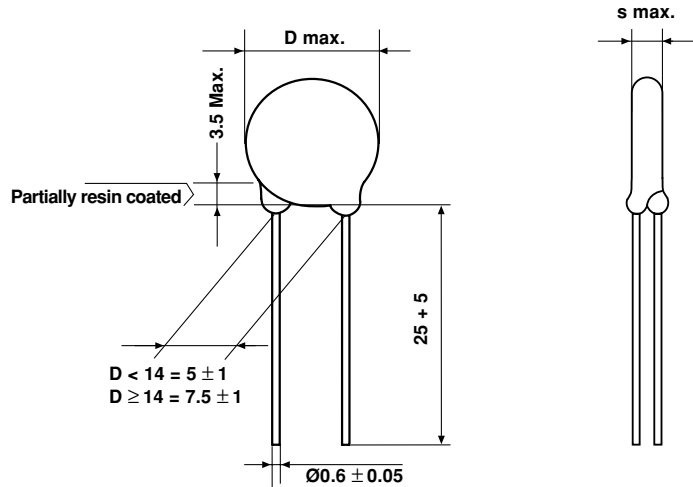
Capacitance value	Code acc. IEC 60062
Capacitance tolerance	with letter code
Ceramic dielectric	with colour band or letter code (see General Information)

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 40 to + 85 °C)

CLIMATIC CATEGORY ACC. TO EN 60068-1:

40 / 085 / 21



• Dimensions in mm

COATING:

Phenol resin, dipped

TEMPERATURE COEFFICIENT OF CAPACITANCE:

See diagrams in General Information
Other ceramic dielectrics are available on request

TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

ORDERING INFORMATION

RLA MODEL	927 CAPACITANCE VALUE	C TOLERANCE	AQ RATED VOLTAGE	BY0 LEAD CONFIGURATION	K INTERNAL CODE
--------------	-----------------------------	----------------	------------------------	------------------------------	-----------------------



		CERAMIC DIELECTRIC: P 100 CERAMIC CODE: RED OR A CAPACITANCE TOLERANCES: C < 10 pF: ±0.25pF, ±0.5pF C ≥ 10 pF: ±5%, ±10%		CERAMIC DIELECTRIC: NP 0 CERAMIC CODE: BLACK OR C CAPACITANCE TOLERANCES: C < 10pF: ±0.25pF, ±0.5pF C ≥ 10pF: ±5%, ±10%		
RATED VOLTAGE = 500V _{DC}						
CAP. VALUE (pF)	D x s (MAX) (mm)	F ± 1* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ± 1* (mm)	ORDERING CODE
1.0	7.0 x 5.0	5	RLA 910□AQ□□□K / S	7.0 x 5.0	5	RLC 915□AQ□□□K / S
1.1	7.0 x 5.0		RLA 911□AQ□□□K / S			RLC 916□AQ□□□K / S
1.2	7.0 x 5.0		RLA 912□AQ□□□K / S			RLC 918□AQ□□□K / S
1.3	7.0 x 5.0		RLA 913□AQ□□□K / S			RLC 920□AQ□□□K / S
1.5	7.0 x 5.0		RLA 915□AQ□□□K / S			RLC 922□AQ□□□K / S
1.6	7.0 x 5.0		RLA 916□AQ□□□K / S			RLC 924□AQ□□□K / S
1.8	7.0 x 5.0		RLA 918□AQ□□□K / S			RLC 927□AQ□□□K / S
2.0	7.0 x 5.0		RLA 920□AQ□□□K / S			RLC 930□AQ□□□K / S
2.2	7.0 x 5.0		RLA 922□AQ□□□K / S			RLC 933□AQ□□□K / S
2.4	7.0 x 5.0		RLA 924□AQ□□□K / S			RLC 936□AQ□□□K / S
2.7	7.0 x 5.0		RLA 927□AQ□□□K / S			RLC 939□AQ□□□K / S
3.0	7.0 x 5.0		RLA 930□AQ□□□K / S			RLC 943□AQ□□□K / S
3.3	7.0 x 5.0		RLA 933□AQ□□□K / S			RLC 947□AQ□□□K / S
3.6	7.0 x 5.0		RLA 936□AQ□□□K / S			RLC 951□AQ□□□K / S
3.9	7.0 x 5.0		RLA 939□AQ□□□K / S			RLC 956□AQ□□□K / S
4.3	10.0 x 5.0		RLA 943□AQ□□□K / S			RLC 962□AQ□□□K / S
4.7	10.0 x 5.0		RLA 947□AQ□□□K / S			RLC 968□AQ□□□K / S
5.1	10.0 x 5.0		RLA 951□AQ□□□K / S			RLC 975□AQ□□□K / S
5.6	10.0 x 5.0		RLA 956□AQ□□□K / S			RLC 982□AQ□□□K / S
6.2	10.0 x 5.0		RLA 962□AQ□□□K / S			RLC 991□AQ□□□K / S
6.8	10.0 x 5.0	RLA 968□AQ□□□K / S	RLC 100□AQ□□□K / S			
7.5	10.0 x 5.0	RLA 975□AQ□□□K / S	RLC 110□AQ□□□K / S			
8.2	10.0 x 5.0	RLA 982□AQ□□□K / S	RLC 120□AQ□□□K / S			
9.1	14.0 x 5.0	7.5	RLA 991□AQ□□□K / S	14.0 x 5.0	7.5	RLC 130□AQ□□□K / S
10	14.0 x 5.0		RLA 100□AQ□□□K / S			RLC 150□AQ□□□K / S
11						RLC 160□AQ□□□K / S
12						RLC 180□AQ□□□K / S
13						RLC 200□AQ□□□K / S
15						RLC 220□AQ□□□K / S
16						
18						
20						
22						

*Standard lead configuration, other lead spacing and diameter available on request

ORDERING CODE			
Ordering code	□ 7th digit	Capacitance tolerance	± 0.25pF = C ± 0.5pF = D ± 5% = J ± 10% = K
	□□□ 10th / 11th / 12th digit	Lead configuration (See General Information)	



		CERAMIC DIELECTRIC: N 150 CERAMIC CODE: ORANGE OR P CAPACITANCE TOLERANCES: C < 10pF: ±0.25pF, ±0.5pF C ≥ 10pF: ±5%, ±10%				CERAMIC DIELECTRIC: N 750 CERAMIC CODE: VIOLET OR U CAPACITANCE TOLERANCES: C < 10pF: ±0.25pF, ±0.5pF C ≥ 10pF: ±5%, ±10%	
RATED VOLTAGE = 500V _{DC}							
CAP. VALUE (pF)	D x s (MAX) (mm)	F ± 1* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ± 1* (mm)	ORDERING CODE	
2.2	7.0 x 5.0	5	RLP 922□AQ□□□K / S		5		
2.4	7.0 x 5.0		RLP 924□AQ□□□K / S				
2.7	7.0 x 5.0		RLP 927□AQ□□□K / S				
3.0	7.0 x 5.0		RLP 930□AQ□□□K / S				
3.3	7.0 x 5.0		RLP 933□AQ□□□K / S				7.0 x 5.0
3.6	7.0 x 5.0		RLP 936□AQ□□□K / S	7.0 x 5.0			
3.9	7.0 x 5.0		RLP 939□AQ□□□K / S	7.0 x 5.0			
4.3	7.0 x 5.0		RLP 943□AQ□□□K / S	7.0 x 5.0			
4.7	7.0 x 5.0		RLP 947□AQ□□□K / S	7.0 x 5.0			
5.1	7.0 x 5.0		RLP 951□AQ□□□K / S	7.0 x 5.0			
5.6	7.0 x 5.0		RLP 956□AQ□□□K / S	7.0 x 5.0			
6.2	7.0 x 5.0		RLP 962□AQ□□□K / S	7.0 x 5.0			
6.8	7.0 x 5.0		RLP 968□AQ□□□K / S	7.0 x 5.0			
7.5	7.0 x 5.0		RLP 975□AQ□□□K / S	7.0 x 5.0			
8.2	7.0 x 5.0		RLP 982□AQ□□□K / S	7.0 x 5.0			
9.1	7.0 x 5.0		RLP 991□AQ□□□K / S	7.0 x 5.0			
10	7.0 x 5.0		RLP 100□AQ□□□K / S	7.0 x 5.0			
11	10.0 x 5.0	RLP 110□AQ□□□K / S	7.0 x 5.0				
12	10.0 x 5.0	RLP 120□AQ□□□K / S	7.0 x 5.0				
13	10.0 x 5.0	RLP 130□AQ□□□K / S	7.0 x 5.0				
15	10.0 x 5.0	RLP 150□AQ□□□K / S	7.0 x 5.0				
16	10.0 x 5.0	RLP 160□AQ□□□K / S	7.0 x 5.0				
18	10.0 x 5.0	RLP 180□AQ□□□K / S	7.0 x 5.0				
20	10.0 x 5.0	RLP 200□AQ□□□K / S	7.0 x 5.0				
22	10.0 x 5.0	RLP 220□AQ□□□K / S	7.0 x 5.0				
24	10.0 x 5.0	RLP 240□AQ□□□K / S	7.0 x 5.0				
27	14.0 x 5.0	7.5	RLP 270□AQ□□□K / S	7.0 x 5.0	7.5	RLU 933□AQ□□□K / S	
30	14.0 x 5.0		RLP 300□AQ□□□K / S	10.0 x 5.0		RLU 936□AQ□□□K / S	
33	14.0 x 5.0		RLP 330□AQ□□□K / S	10.0 x 5.0		RLU 939□AQ□□□K / S	
36				10.0 x 5.0		RLU 943□AQ□□□K / S	
39				10.0 x 5.0		RLU 947□AQ□□□K / S	
43				10.0 x 5.0		RLU 951□AQ□□□K / S	
47				10.0 x 5.0		RLU 956□AQ□□□K / S	
51				10.0 x 5.0		RLU 962□AQ□□□K / S	
56				10.0 x 5.0		RLU 968□AQ□□□K / S	
62				14.0 x 5.0		RLU 975□AQ□□□K / S	
68				14.0 x 5.0		RLU 982□AQ□□□K / S	
						RLU 991□AQ□□□K / S	
						RLU 100□AQ□□□K / S	
						RLU 110□AQ□□□K / S	
						RLU 120□AQ□□□K / S	
						RLU 130□AQ□□□K / S	
						RLU 150□AQ□□□K / S	
						RLU 160□AQ□□□K / S	
						RLU 180□AQ□□□K / S	
						RLU 200□AQ□□□K / S	
						RLU 220□AQ□□□K / S	
						RLU 240□AQ□□□K / S	
						RLU 270□AQ□□□K / S	
						RLU 300□AQ□□□K / S	
						RLC 330□AQ□□□K / S	
						RLU 360□AQ□□□K / S	
						RLU 390□AQ□□□K / S	
						RLU 430□AQ□□□K / S	
						RLU 470□AQ□□□K / S	
						RLU 510□AQ□□□K / S	
						RLU 560□AQ□□□K / S	
						RLU 620□AQ□□□K / S	
						RLU 680□AQ□□□K / S	

*Standard lead configuration, other lead spacing and diameter available on request

ORDERING CODE			
Ordering code	□ 7th digit	Capacitance tolerance	± 0.25pF = C ± 0.5pF = D ± 5% = J ± 10% = K
	□□□ 10th / 11th / 12th digit	Lead configuration (See General Information)	



		CERAMIC DIELECTRIC: N 1500 CERAMIC CODE: ORANGE/ORANGE OR V CAPACITANCE TOLERANCES: C < 10pF: ±0.25pF, ±0.5pF C ≥ 10pF: ±5%, ±10%		CERAMIC DIELECTRIC: N 2200 CERAMIC CODE: YELLOW/ORANGE OR K CAPACITANCE TOLERANCES: C < 10pF: ±0.25pF, ±0.5pF C ≥ 10pF: ±5%, ±10%		
RATED VOLTAGE = 500V _{DC}						
CAP. VALUE (pF)	D x s (MAX) (mm)	F ± 1* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ± 1* (mm)	ORDERING CODE
3.3	7.0 x 5.0	5	RLV 933□AQ□□□K / S	7.0 x 5.0	5	RLK 956□AQ□□□K / S
3.6	7.0 x 5.0		RLV 936□AQ□□□K / S			RLK 962□AQ□□□K / S
3.9	7.0 x 5.0		RLV 939□AQ□□□K / S			RLK 968□AQ□□□K / S
4.3	7.0 x 5.0		RLV 943□AQ□□□K / S			RLK 975□AQ□□□K / S
4.7	7.0 x 5.0		RLV 947□AQ□□□K / S			RLK 982□AQ□□□K / S
5.1	7.0 x 5.0		RLV 951□AQ□□□K / S			RLK 991□AQ□□□K / S
5.6	7.0 x 5.0		RLV 956□AQ□□□K / S	RLK 100□AQ□□□K / S		
6.2	7.0 x 5.0		RLV 962□AQ□□□K / S	RLK 110□AQ□□□K / S		
6.8	7.0 x 5.0		RLV 968□AQ□□□K / S	RLK 120□AQ□□□K / S		
7.5	7.0 x 5.0		RLV 975□AQ□□□K / S	RLK 130□AQ□□□K / S		
8.2	7.0 x 5.0		RLV 982□AQ□□□K / S	RLK 150□AQ□□□K / S		
9.1	7.0 x 5.0		RLV 991□AQ□□□K / S	RLK 160□AQ□□□K / S		
10	7.0 x 5.0		RLV 100□AQ□□□K / S	RLK 180□AQ□□□K / S		
11	7.0 x 5.0		RLV 110□AQ□□□K / S	RLK 200□AQ□□□K / S		
12	7.0 x 5.0		RLV 120□AQ□□□K / S	RLK 220□AQ□□□K / S		
13	7.0 x 5.0		RLV 130□AQ□□□K / S	RLK 240□AQ□□□K / S		
15	7.0 x 5.0		RLV 150□AQ□□□K / S	RLK 270□AQ□□□K / S		
16	7.0 x 5.0		RLV 160□AQ□□□K / S	RLK 300□AQ□□□K / S		
18	7.0 x 5.0		RLV 180□AQ□□□K / S	RLK 330□AQ□□□K / S		
20	7.0 x 5.0		RLV 200□AQ□□□K / S	RLK 360□AQ□□□K / S		
22	7.0 x 5.0	RLV 220□AQ□□□K / S	RLK 390□AQ□□□K / S			
24	7.0 x 5.0	RLV 240□AQ□□□K / S	RLK 430□AQ□□□K / S			
27	7.0 x 5.0	RLV 270□AQ□□□K / S	RLK 470□AQ□□□K / S			
30	7.0 x 5.0	RLV 300□AQ□□□K / S	RLK 510□AQ□□□K / S			
33	7.0 x 5.0	RLV 330□AQ□□□K / S	RLK 560□AQ□□□K / S			
36	7.0 x 5.0	RLV 360□AQ□□□K / S	RLK 620□AQ□□□K / S			
39	7.0 x 5.0	RLV 390□AQ□□□K / S	RLK 680□AQ□□□K / S			
43	7.0 x 5.0	RLV 430□AQ□□□K / S	RLK 750□AQ□□□K / S			
47	7.0 x 5.0	RLV 470□AQ□□□K / S	RLK 820□AQ□□□K / S			
51	10.0 x 5.0	RLV 510□AQ□□□K / S	RLK 910□AQ□□□K / S			
56	10.0 x 5.0	RLV 560□AQ□□□K / S	RLK 101□AQ□□□K / S			
62	10.0 x 5.0	RLV 620□AQ□□□K / S	RLK 111□AQ□□□K / S			
68	10.0 x 5.0	RLV 680□AQ□□□K / S	RLK 121□AQ□□□K / S			
75	10.0 x 5.0	RLV 750□AQ□□□K / S	RLK 131□AQ□□□K / S			
82	14.0 x 5.0	RLV 820□AQ□□□K / S	RLK 151□AQ□□□K / S			
91	14.0 x 5.0	RLV 910□AQ□□□K / S	RLK 161□AQ□□□K / S			
100	14.0 x 5.0	RLV 101□AQ□□□K / S	RLK 181□AQ□□□K / S			
110			10.0 x 5.0	7.5		
120			10.0 x 5.0			
130			14.0 x 5.0			
150			14.0 x 5.0			
160			14.0 x 5.0			
180			14.0 x 5.0			

*Standard lead configuration, other lead spacing and diameter available on request

ORDERING CODE			
Ordering code	□ 7th digit	Capacitance tolerance	± 0.25pF = C ± 0.5pF = D ± 5% = J ± 10% = K
	□□□ 10th / 11th / 12th digit	Lead configuration (See General Information)	

Ceramic Disc Capacitors, Class 2

DESIGN:

Disc capacitors with epoxy coating

RATED VOLTAGE U_R :

500V_{DC}

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test

1250V_{DC}, 2s

DISSIPATION FACTOR $\tan \delta$:

$\leq 30 \cdot 10^{-3}$

INSULATION RESISTANCE R_{IS} :

$\geq 5 \cdot 10^9 \Omega$

MARKING:

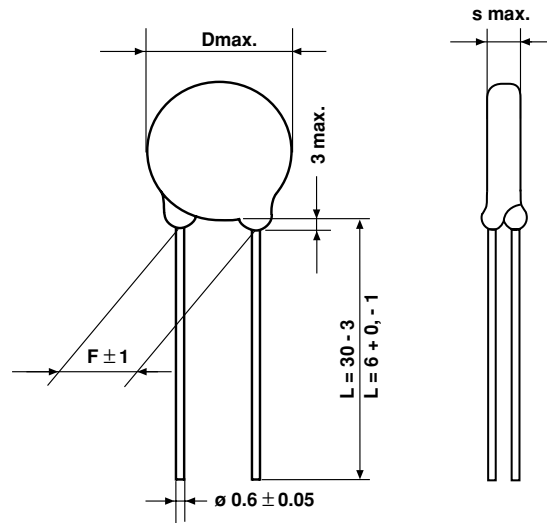
Capacitance value	Clear text
Capacitance tolerance	with letter code
Ceramic dielectric	with letter code
	(see General Information)

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 40 to + 85°C)

CLIMATIC CATEGORY ACC. TO EN 60068-1:

40 / 085 / 21



• Dimensions in mm

COATING:

Epoxy dipped, insulating, flame retarding acc. to UL 94V-0

TEMPERATURE CHARACTERISTIC OF CAPACITANCE:

See diagrams in General Information

TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

ORDERING INFORMATION

HSE	471	K	AQ	BF0	K
MODEL	CAPACITANCE VALUE	TOLERANCE	RATED VOLTAGE	LEAD CONFIGURATION	INTERNAL CODE



		CERAMIC DIELECTRIC: K 2000 CERAMIC CODE: Z CAPACITANCE TOLERANCE: ± 10%, ± 20%		CERAMIC DIELECTRIC: K 4000 CERAMIC CODE: E CAPACITANCE TOLERANCE: + 50 - 20%, (± 20%)**				
RATED VOLTAGE = 500V_{DC}								
CAP. VALUE (pF)	D x s (MAX) (mm)	F ± 1* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ± 1* (mm)	ORDERING CODE		
10	6.0 x 4.0	5	HSZ 100□AQ□□□ K	6.0 x 4.0	5			
12	6.0 x 4.0		HSZ 120□AQ□□□ K					
15	6.0 x 4.0		HSZ 150□AQ□□□ K					
18	6.0 x 4.0		HSZ 180□AQ□□□ K					
22	6.0 x 4.0		HSZ 220□AQ□□□ K					
27	6.0 x 4.0		HSZ 270□AQ□□□ K					
33	6.0 x 4.0		HSZ 330□AQ□□□ K					
39	6.0 x 4.0		HSZ 390□AQ□□□ K					
47	6.0 x 4.0		HSZ 470□AQ□□□ K					
56	6.0 x 4.0		HSZ 560□AQ□□□ K					
68	6.0 x 4.0		HSZ 680□AQ□□□ K					
82	6.0 x 4.0		HSZ 820□AQ□□□ K					
100	6.0 x 4.0		HSZ 101□AQ□□□ K					
120	6.0 x 4.0		HSZ 121□AQ□□□ K					
150	6.0 x 4.0		HSZ 151□AQ□□□ K					
180	6.0 x 4.0		HSZ 181□AQ□□□ K					
220	6.0 x 4.0		HSZ 221□AQ□□□ K					
270	6.0 x 4.0		HSZ 271□AQ□□□ K					
330	6.0 x 4.0		HSZ 331□AQ□□□ K					
390	6.0 x 4.0		HSZ 391□AQ□□□ K					
470	6.0 x 4.0	7.5	HSZ 471□AQ□□□ K	6.0 x 4.0	5	HSE 471□AQ□□□ K		
560	7.0 x 4.0		HSZ 561□AQ□□□ K					
680	7.0 x 4.0		HSZ 681□AQ□□□ K	6.0 x 4.0				HSE 681□AQ□□□ K
820	7.0 x 4.0		HSZ 821□AQ□□□ K					
1000	7.0 x 4.0		HSZ 102□AQ□□□ K	6.0 x 4.0				HSE 102□AQ□□□ K
1200	8.0 x 4.0		HSZ 122□AQ□□□ K					
1500	8.0 x 4.0		HSZ 152□AQ□□□ K	7.0 x 4.0				HSE 152□AQ□□□ K
1800	8.0 x 4.0		HSZ 182□AQ□□□ K					
2200	9.0 x 4.0		HSZ 222□AQ□□□ K	7.0 x 4.0				HSE 222□AQ□□□ K
2700	11.0 x 4.0		HSZ 272□AQ□□□ K					
3300	11.0 x 4.0	7.5	HSZ 332□AQ□□□ K	11.0 x 4.0	7.5	HSE 332□AQ□□□ K		
3900	13.0 x 4.0		HSZ 392□AQ□□□ K					
4700	13.0 x 4.0		HSZ 472□AQ□□□ K	11.0 x 4.0				HSE 472□AQ□□□ K
6800				13.0 x 4.0				HSE 682□AQ□□□ K
8200			15.0 x 4.0			HSE 822□AQ□□□ K		
0.01μF			15.0 x 4.0			HSE 103□AQ□□□ K		

*Standard lead configuration, other lead spacing and diameter available on request. **± 20% available on request.

ORDERING CODE			
Ordering code	□ 7th digit	Capacitance tolerance	± 10% = K ± 20% = M + 50 - 20% = S
	□□□ 10th / 11th / 12th digit	Lead configuration (See General Information)	

Ceramic High Voltage Disc Capacitors, Class 1

DESIGN:

Disc capacitors with epoxy coating

RATED VOLTAGE U_R :

- HAU 1kV_{DC}
- HBU 2kV_{DC}
- HCU 3kV_{DC}
- HDU 4kV_{DC}
- HEU 5kV_{DC}
- HFU 6kV_{DC}

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test

- HAU 1750V_{DC}, 2s
- HBU 3000V_{DC}, 2s
- HCU 5000V_{DC}, 2s
- HDU 6000V_{DC}, 2s
- HEU 7500V_{DC}, 2s
- HFU 9000V_{DC}, 2s

DISSIPATION FACTOR $\tan \delta$:

$$C < 30\text{pF}: \left(\frac{100}{C} + 7\right) \cdot 10^{-4}$$

$$C \geq 30\text{pF}: \leq 10 \cdot 10^{-4}$$

INSULATION RESISTANCE R_{IS} :

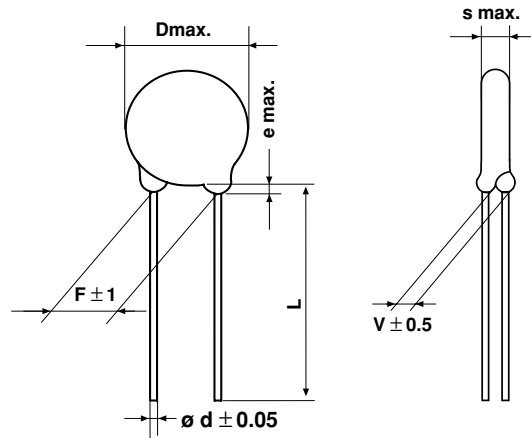
$$\geq 1 \cdot 10^{10}\Omega$$

MARKING:

- Capacitance value - Clear text
- Capacitance tolerance - With letter code
- Rated voltage - Clear text
- Ceramic Dielectric - With letter code U
- Manufacturers logo - Where D \geq 13mm only

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 40 to + 85°C)



• Dimensions in mm

	Coating extension e	Standard lead length L
HAU	3 max.	30 - 3 or 10 ± 1
HBU	3 max.	
HCU	3 max.	
HDU	3 max.	
HEU	3 max.	
HFU	3 max.	

CLIMATIC CATEGORY ACC. TO EN 60068-1:

40 / 085 / 21

COATING:

Epoxy dipped, insulating, flame retarding acc. to UL 94V-0

TEMPERATURE COEFFICIENT OF THE CAPACITANCE:

See diagrams in General Information

LEAD CONFIGURATION & TAPING:

See General Information

ORDERING INFORMATION

HAU	220	K	BA	CD0	K
MODEL	CAPACITANCE VALUE	TOLERANCE	RATED VOLTAGE	LEAD CONFIGURATION	INTERNAL CODE



		CERAMIC DIELECTRIC: CERAMIC CODE: CAPACITANCE TOLERANCE:			N 750 U ± 10%		CERAMIC DIELECTRIC: CERAMIC CODE: CAPACITANCE TOLERANCE:			N 750 U ± 10%	
		RATED VOLTAGE = 1kV _{DC}					RATED VOLTAGE = 2kV _{DC}				
CAP. VALUE	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE	
10	7.0 x 3.0	7.5	0.6	1.4	HAU100KBA□□□K	7.0 x 4.0	7.5	0.6	1.2	HBU100KBB□□□K	
15	7.0 x 3.0				HAU150KBA□□□K	7.0 x 4.0				HBU150KBB□□□K	
22	7.0 x 3.0				HAU220KBA□□□K	7.0 x 4.0				HBU220KBB□□□K	
33	8.0 x 3.0				HAU330KBA□□□K	7.0 x 4.0				HBU330KBB□□□K	
47	8.0 x 3.0				HAU470KBA□□□K	7.0 x 4.0				HBU470KBB□□□K	
68	8.0 x 3.0				HAU680KBA□□□K	8.0 x 4.0				HBU680KBB□□□K	
82	8.0 x 3.0				HAU820KBA□□□K	8.0 x 4.2				HBU820KBB□□□K	
100	8.0 x 3.0				HAU101KBA□□□K	10.0 x 4.2				HBU101KBB□□□K	
150	10.0 x 3.5				HAU151KBA□□□K	10.0 x 4.2				HBU151KBB□□□K	
220	11.0 x 3.5				HAU221KBA□□□K	12.0 x 4.2				HBU221KBB□□□K	
330	12.5 x 3.5				HAU331KBA□□□K	15.0 x 4.2				HBU331KBB□□□K	
470	14.5 x 3.5				HAU471KBA□□□K	17.0 x 4.2				HBU471KBB□□□K	
560	16.5 x 3.5				HAU561KBA□□□K						
680	16.5 x 3.5				HAU681KBA□□□K						

		RATED VOLTAGE = 3kV _{DC}				RATED VOLTAGE = 4kV _{DC}				
10	7.0 x 4.0	10	0.6	1.3	HCU100KBC□□□K	7.0 x 4.3	10	0.6	1.7	HDU100KBD□□□K
15	7.0 x 4.0				HCU150KBC□□□K	7.0 x 4.3				HDU150KBD□□□K
22	7.0 x 4.0				HCU220KBC□□□K	7.0 x 4.3				HDU220KBD□□□K
33	7.0 x 4.0			HCU330KBC□□□K	7.0 x 4.3	HDU330KBD□□□K				
47	8.0 x 4.0			HCU470KBC□□□K	9.5 x 4.3	HDU470KBD□□□K				
68	9.0 x 4.0			HCU680KBC□□□K	9.5 x 4.7	HDU680KBD□□□K				
82	10.0 x 4.4		0.8	1.6	HCU820KBC□□□K	11.0 x 4.7		0.8	1.9	HDU820KBD□□□K
100	10.0 x 4.4				HCU101KBC□□□K	11.0 x 4.7				HDU101KBD□□□K
150	11.0 x 4.4				HCU151KBC□□□K	13.0 x 4.7				HDU151KBD□□□K
220	15.0 x 4.4				HCU221KBC□□□K	15.0 x 4.7				HDU221KBD□□□K
330	17.0 x 4.4				HCU331KBC□□□K	17.0 x 4.7				HDU331KBD□□□K
470										20.0 x 4.7

		RATED VOLTAGE = 5kV _{DC}				RATED VOLTAGE = 6kV _{DC}				
10		12.5	0.6	2.2	HEU220KBE□□□K	7.0 x 4.8	12.5	0.6	2.2	HFU100KBF□□□K
15					HEU330KBE□□□K	7.0 x 4.8				HFU150KBF□□□K
22	7.0 x 4.8				HEU470KBE□□□K	9.5 x 4.8				HFU220KBF□□□K
33	9.3 x 4.8			HEU680KBE□□□K	9.5 x 4.8	HFU330KBF□□□K				
47	9.3 x 4.8			HEU820KBE□□□K	12.0 x 5.2	HFU470KBF□□□K				
68	11.8 x 5.2			HEU101KBE□□□K	12.0 x 5.2	HFU680KBF□□□K				
82	11.8 x 5.2		0.8	2.4	HEU151KBE□□□K	12.0 x 5.2		0.8	2.4	HFU820KBF□□□K
100	11.8 x 5.2				HEU221KBE□□□K	15.0 x 5.2				HFU101KBF□□□K
150	14.4 x 5.2				HEU331KBE□□□K	17.0 x 5.2				HFU151KBF□□□K
220	16.3 x 5.2									HFU221KBF□□□K
330	19.5 x 5.2									HFU331KBF□□□K

* Standard lead configuration, other lead spacing and diameter available on request

ORDERING CODE		
Ordering code	□□□ 10th / 11th / 12th digit	Lead configuration (See General Information)

Ceramic High Voltage Disc Capacitors, Class 2

DESIGN:

Disc capacitor with epoxy coating

RATED VOLTAGE U_R :

HAZ, HAE, HAX	1kV _{DC}
HBZ, HBE, HBX	2kV _{DC}
HCZ, HCE, HCX	3kV _{DC}
HDE	4kV _{DC}
HEE	5kV _{DC}
HFZ, HFE	6kV _{DC}
HGZ	8kV _{DC}
HHZ	10kV _{DC}
HIZ	15kV _{DC}

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test

HAZ, HAE, HAX	1750V _{DC} , 2s
HBZ, HBE, HBX	3000V _{DC} , 2s
HCZ, HCE, HCX	5000V _{DC} , 2s
HDE	6000V _{DC} , 2s
HEE	7500V _{DC} , 2s
HFZ, HFE	9000V _{DC} , 2s
HGZ	12000V _{DC} , 2s
HHZ	15000V _{DC} , 2s
HIZ	22500V _{DC} , 2s

DISSIPATION FACTOR $\tan \delta$:

HA., HB., HC., HD., HE	$\leq 25 \cdot 10^{-3}$
HF., HG., HH., HI.	$\leq 20 \cdot 10^{-3}$

INSULATION RESISTANCE R_{IS} :

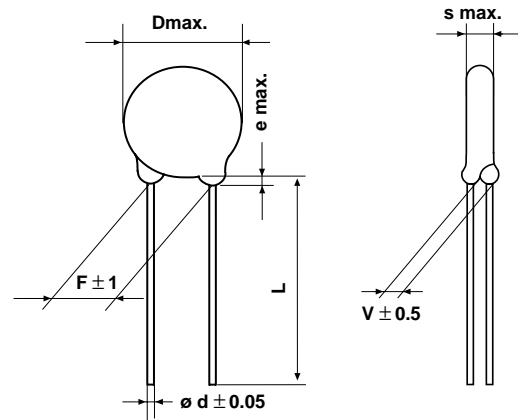
$\geq 1 \cdot 10^{10} \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 40 to + 85 C)

CLIMATIC CATEGORY ACC. TO EN 60068-1:

40 / 085 / 21



• Dimensions in mm

	Coating Extension e	Standard Lead Length L
HA., HB., HC.	3 max.	30 - 3
HD., HE., HF.,		or
HGZ, HHZ, HIZ	5 max.	10 ± 1

COATING:

Epoxy dipped, insulating,
Flame retarding acc. to UL 94V-0

TEMPERATURE CHARACTERISTIC OF CAPACITANCE:

See General Information

TAPING AND SPECIAL LEAD CONFIGURATIONS:

See General Information

MARKING:

Capacitance value	- Clear text
Capacitance tolerance	- Where $D \geq 9\text{mm}$ only
Rated voltage	- Clear text
Ceramic dielectric	- With Letter code
Manufacturers logo	- Where $D \geq 13\text{mm}$ only

ORDERING INFORMATION

HIZ	101	M	BJ	EJ0	K
MODEL	CAPACITANCE VALUE	TOLERANCE	RATED VOLTAGE	LEAD CONFIGURATION	INTERNAL CODE



		CERAMIC DIELECTRIC: K 2000 CERAMIC CODE: Z CAPACITANCE TOLERANCE: ±10%, ±20%			CERAMIC DIELECTRIC: K 6000 CERAMIC CODE: E CAPACITANCE TOLERANCE: ±20%			CERAMIC DIELECTRIC: K 10000 CERAMIC CODE: X CAPACITANCE TOLERANCE: +50 -20%, (±20%)**																					
		RATED VOLTAGE = 1kV _{DC}			RATED VOLTAGE = 1kV _{DC}			RATED VOLTAGE = 1kV _{DC}																					
CAP. VALUE (pF)	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE														
47	7 x 3	5	0.6	1.2	HAZ470□BA□□□K																								
56	7 x 3				HAZ560□BA□□□K																								
68	7 x 3				HAZ680□BA□□□K																								
82	7 x 3				HAZ820□BA□□□K																								
100	7 x 3				HAZ101□BA□□□K																								
150	7 x 3				HAZ151□BA□□□K																								
220	7 x 3				HAZ221□BA□□□K																								
330	7 x 3				HAZ331□BA□□□K																								
470	7 x 3				HAZ471□BA□□□K																								
680	7 x 3				HAZ681□BA□□□K																								
1000	9 x 3				HAZ102□BA□□□K											7 x 3	5	0.6	1.2	HAE102MBA□□□K									
1500	9 x 3				HAZ152□BA□□□K											9 x 3				HAE152MBA□□□K									
2200	11 x 3				HAZ222□BA□□□K											9 x 3	5	0.6	1.2	HAE222MBA□□□K	7 x 3	5						HAX222SBA□□□K	
3300	13 x 3				HAZ332□BA□□□K											11 x 3	HAE332MBA□□□K	9 x 3	HAX332SBA□□□K										
4700	15 x 3	HAZ472□BA□□□K	11 x 3	HAE472MBA□□□K	9 x 3	HAX472SBA□□□K																							
6800																HAX682SBA□□□K													
0.010μF						13 x 3	7.5									HAX103SBA□□□K													
0.015μF						15 x 3										HAX153SBA□□□K													
0.022μF																HAX223SBA□□□K													
		RATED VOLTAGE = 2kV _{DC}			RATED VOLTAGE = 2kV _{DC}			RATED VOLTAGE = 2kV _{DC}																					
56	7 x 3	7.5	0.6	1.4	HBZ560□BB□□□K																								
68	7 x 3				HBZ680□BB□□□K																								
82	7 x 3				HBZ820□BB□□□K																								
100	7 x 3				HBZ101□BB□□□K																								
150	7 x 3				HBZ151□BB□□□K																								
220	7 x 3				HBZ221□BB□□□K																								
330	7 x 3				HBZ331□BB□□□K																								
470	7 x 3				HBZ471□BB□□□K																								
680	9 x 3				HBZ681□BB□□□K											7 x 3	7.5	0.6	1.4	HBE681MBB□□□K									
1000	9 x 3				HBZ102□BB□□□K											7 x 3				HBE102MBB□□□K									
1500	11 x 3				HBZ152□BB□□□K											9 x 3	7.5	0.6	1.4	HBE152MBB□□□K	7 x 3	7.5	0.6	1.2					HBX152SBB□□□K
2200	13 x 3				HBZ222□BB□□□K											9 x 3	HBE222MBB□□□K	9 x 3	HBX222SBB□□□K										
3300	15 x 3				HBZ332□BB□□□K											11 x 3	HBE332MBB□□□K	9 x 3	HBX332SBB□□□K										
4700	17 x 3				HBZ472□BB□□□K											13 x 3	HBE472MBB□□□K	11 x 3	HBX472SBB□□□K										
6800			15 x 3	HBE682MBB□□□K	11 x 3	HBX682SBB□□□K																							
0.01μF			17 x 3	HBE103MBB□□□K	15 x 3	HBX103SBB□□□K																							
0.015μF																HBX153SBB□□□K													
0.022μF																HBX223SBB□□□K													

* Standard lead configuration, other lead spacing and diameter available on request

** ± 20% available on request



		CERAMIC DIELECTRIC: K 2000 CERAMIC CODE: Z CAPACITANCE TOLERANCE: ± 10%, ± 20%				CERAMIC DIELECTRIC: K 6000 CERAMIC CODE: E CAPACITANCE TOLERANCE: ± 20%				CERAMIC DIELECTRIC: K 10000 CERAMIC CODE: X CAPACITANCE TOLERANCE: + 50 - 20%, (± 20 %)***																		
		RATED VOLTAGE = 3kV _{DC}				RATED VOLTAGE = 3kV _{DC}				RATED VOLTAGE = 3kV _{DC}																		
CAP. VALUE (pF)	D x s (MAX) (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE													
68	7 x 4	10	0.6	1.8	HCZ680□BC□□□K	7 x 4	10	0.6	2	HCE471MBC□□□□K	7 x 4	10	0.6	1.8	HCX681SBC□□□□K													
82	7 x 4				HCZ820□BC□□□K											HCE681MBC□□□□K												
100	7 x 4				HCZ101□BC□□□K											HCE102MBC□□□□K												
120	7 x 4				HCZ121□BC□□□K																							
150	7 x 4				HCZ151□BC□□□K																							
180	8 x 4				HCZ181□BC□□□K																							
220	8 x 4				HCZ221□BC□□□K																							
330	8 x 4				HCZ331□BC□□□K																							
470	10 x 4				HCZ471□BC□□□K																							
680	10 x 4				HCZ681□BC□□□K																							
1000	11 x 4	0.8	2	10	HCZ102□BC□□□K	9 x 4	0.8	2.2	HCE103MBC□□□□K	7 x 4	10	0.8	2	HCX102SBC□□□□K														
1200	15 x 4				HCZ122□BC□□□K										HCE152MBC□□□□K													
1500	15 x 4				HCZ152□BC□□□K										HCE222MBC□□□□K													
2200	17 x 4				HCZ222□BC□□□K										HCE222MBC□□□□K													
3300	21 x 4				HCZ332□BC□□□K										HCE332MBC□□□□K													
4700	21 x 4				HCZ472□BC□□□K										HCE472MBC□□□□K													
6800	25 x 4				HCZ682□BC□□□K										HCE682SBC□□□□K													
0.01μF																	25 x 4											
0.015μF																							21 x 4					HCX153SBC□□□□K

		CERAMIC DIELECTRIC: K 6000 CERAMIC CODE: E CAPACITANCE TOLERANCE: ± 20%, (± 10%)**				CERAMIC DIELECTRIC: K 6000 CERAMIC CODE: E CAPACITANCE TOLERANCE: ± 20%					
		RATED VOLTAGE = 4kV _{DC}				RATED VOLTAGE = 5kV _{DC}					
CAP. VALUE (pF)	D x s (MAX) (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	
33	8 x 4.5	12.5	0.6	1.9	HDE330MBD□□□□K	7 x 5.0	12.5	0.6	3.8	HEE221MBE□□□□K	
47	8 x 5.0				HDE470MBD□□□□K						
68	8 x 5.0				HDE680MBD□□□□K						
100	8 x 5.0				HDE101MBD□□□□K						
150	8 x 5.0				HDE151MBD□□□□K						
220	8 x 5.0				HDE221MBD□□□□K						HEE331MBE□□□□K
330	8 x 5.0				HDE331MBD□□□□K						
470	8 x 5.0				HDE471MBD□□□□K						
680	9 x 5.0				HDE681MBD□□□□K						HEE681MBE□□□□K
1000	10 x 5.0				HDE102MBD□□□□K						HEE102MBE□□□□K
1500	12 x 5.0	0.8	2.7	15 x 5.5	HDE152MBD□□□□K	13 x 5.5	15 x 5.5			HEE152MBE□□□□K	
2200	13 x 5.0				HDE222MBD□□□□K					HEE222MBE□□□□K	
3300	15 x 5.0				HDE332MBD□□□□K						
4700	18 x 5.0				HDE472MBD□□□□K						

*Standard lead configuration, other lead spacing and diameter available on request

**Narrow tolerance available on request



CAP. VALUE (pF)	CERAMIC DIELECTRIC: K 2000 CERAMIC CODE: Z CAPACITANCE TOLERANCE: ±20%, (±10%)				CERAMIC DIELECTRIC: K 6000 CERAMIC CODE: E CAPACITANCE TOLERANCE: ± 20%				CERAMIC DIELECTRIC : K 2000 CERAMIC CODE : X CAPACITANCE TOLERANCE: ± 20% (± 10%)						
	RATED VOLTAGE = 6kV _{DC}				RATED VOLTAGE = 6kV _{DC}				RATED VOLTAGE = 8kV _{DC}						
	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE
56	7 x 5				HFZ560□BF□□□K										
68	7 x 5				HFZ680□BF□□□K										
82	7 x 5				HFZ820□BF□□□K										
100	8 x 5				HFZ101□BF□□□K						9x8.3				HGZ101MBP□□□K
120	8 x 5				HFZ121□BF□□□K						9x8.3				HGZ121MBP□□□K
150	8 x 5				HFZ151□BF□□□K	7x5				HFE151MBF□□□K	9x8.3				HGZ151MBP□□□K
180	10 x 5		0.6		HFZ181□BF□□□K						11x8.3				HGZ181MBP□□□K
220	10 x 5				HFZ221□BF□□□K	7x5				HFE221MBF□□□K	11x8.3				HGZ221MBP□□□K
270	10 x 5				HFZ271□BF□□□K						11x8.3				HGZ271MBP□□□K
330	10 x 5				HFZ331□BF□□□K	9x5				HFE 331MBF□□□K	13x8.3				HGZ331MBP□□□K
390	12 x 5	12.5		3.5	HFZ391□BF□□□K						13x8.3				HGZ391MBP□□□K
470	12 x 5				HFZ471□BF□□□K	9x5				HFE471MBF□□□K	14x8.3	12.5	0.8	4	HGZ471MBP□□□K
560	13 x 5				HFZ561□BF□□□K						16x8.3				HGZ561MBP□□□K
680	15 x 5				HFZ681□BF□□□K	9x5	12.5	0.6	3.5	HFE681MBF□□□K	16x8.3				HGZ681MBP□□□K
820	15 x 5				HFZ821□BF□□□K						18x8.3				HGZ821MBP□□□K
1000	17 x 5				HFZ102□BF□□□K	11x5.5				HFE102MBF□□□K	18x8.3				HGZ102MBP□□□K
1200	19 x 5				HFZ122□BF□□□K						21x8.3				HGZ122MBP□□□K
1500	21 x 5		0.8		HFZ152□BF□□□K	13x5.5				HFE152MBF□□□K	21x8.3				HGZ152MBP□□□K
1800	21 x 5				HFZ182□BF□□□K						24x8.3				HGZ182MBP□□□K
2200	25 x 5				HFZ222□BF□□□K	15x5.5				HFE222MBF□□□K	24x8.3				HGZ222MBP□□□K
2700	25 x 5				HFZ272□BF□□□K										
3300						21x5.5				HFE332MBF□□□K					
4700						21x5.5		0.8		HFE472MBF□□□K					
6800						23x5.5				HFE682MBF□□□K					

CAP. VALUE (pF)	CERAMIC DIELECTRIC: K 2000 CERAMIC CODE: Z CAPACITANCE TOLERANCE: ± 20%, (± 10%)				CERAMIC DIELECTRIC: K 2000 CERAMIC CODE: Z CAPACITANCE TOLERANCE: ± 20%, (± 10%)					
	RATED VOLTAGE = 10kV _{DC}				RATED VOLTAGE = 15kV _{DC}					
	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ±1* (mm)	d ±0.05* (mm)	V ±0.5* (mm)	ORDERING CODE
100	11 x 6				HHZ101MBH□□□K	18 x 8				HIZ101MBJ□□□K
120	11 x 6				HHZ121MBH□□□K	18 x 8			4	HIZ121MBJ□□□K
150	11 x 9				HHZ151MBH□□□K	12 x 11				HIZ151MBJ□□□K
180	11 x 9				HHZ181MBH□□□K	13 x 11				HIZ181MBJ□□□K
220	11 x 9				HHZ221MBH□□□K	13 x 11				HIZ221MBJ□□□K
270	13 x 9				HHZ271MBH□□□K	14 x 11	12.5	0.8	7	HIZ271MBJ□□□K
330	13 x 9				HHZ331MBH□□□K	15 x 11				HIZ331MBJ□□□K
390	14 x 9	12.5	0.8	5	HHZ391MBH□□□K	16 x 11				HIZ391MBJ□□□K
470	16 x 9				HHZ471MBH□□□K	18 x 11				HIZ471MBJ□□□K
560	16 x 9				HHZ561MBH□□□K	21 x 11				HIZ561MBJ□□□K
680	18 x 9				HHZ681MBH□□□K	21 x 11				HIZ681MBJ□□□K
820	18 x 9				HHZ821MBH□□□K	21 x 11				HIZ821MBJ□□□K
1000	21 x 9				HHZ102MBH□□□K					
1200	21 x 5				HHZ122MBH□□□K					

*Standard lead configuration, other lead spacing and diameter available on request

ORDERING CODE			
Ordering code	□ 7th digit	Capacitance tolerance	± 10% = K ± 20% = M
	□□□ 10th / 11th / 12th digit	Lead configuration (See General Info.)	+ 50 - 20% = S

Ceramic Pulse Disc Capacitors, Class 1

DESIGN:

Disc capacitor with epoxy coating

RATED VOLTAGE U_R :

25kV_{DC}

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test
35 kV_{DC} 5s

DISSIPATION FACTOR $\tan \delta$:

$\leq 5 \cdot 10^{-3}$

INSULATION RESISTANCE R_{IS} :

$\geq 1 \cdot 10^{10} \Omega$

MARKING:

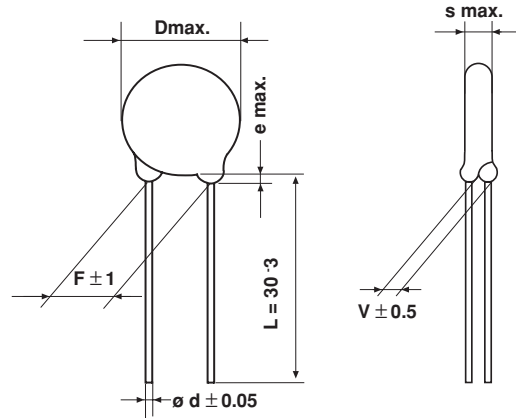
Capacitance value - Clear text
Capacitance tolerance - Letter code
Type - IEL

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 40 to + 125°C)

CLIMATIC CATEGORY ACC. TO EN 60068-1:

40 / 125 / 21



• Dimensions in mm

COATING:

Epoxy dipped, insulating,
Flame retarding acc. to UL 94V-0

TEMPERATURE COEFFICIENT OF CAPACITANCE:

See next page

TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

ORDERING INFORMATION

IEL	360	M	BQ	DF0	K
MODEL	CAPACITANCE VALUE	TOLERANCE	RATED VOLTAGE	LEAD CONFIGURATION	INTERNAL CODE

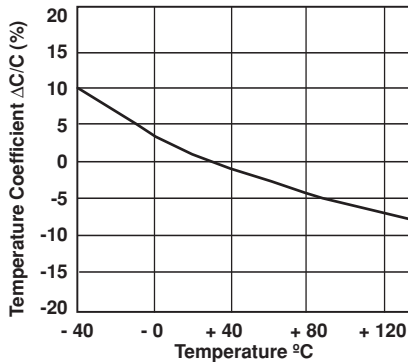


RATED VOLTAGE = 25kV _{DC}							
CAP. VALUE (pF)	D x s (MAX) (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 1* (mm)	e max. (mm)	ORDERING CODE	CERAMIC DIELECTRIC
12	10.0 x 8.0	10	0.8	4.0	3.0	IEL120MBQ□□□K	N 750
15	10.0 x 8.0					IEL150MBQ□□□K	
36	10.0 x 8.0					IEL360MBQ□□□K	N 2200

*Standard lead configuration, other lead spacing and diameter available on request

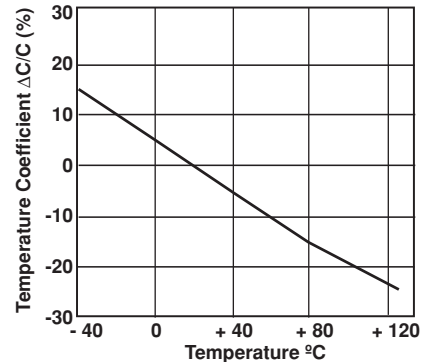
Capacitance tolerance: ± 20%

N 750 CERAMIC

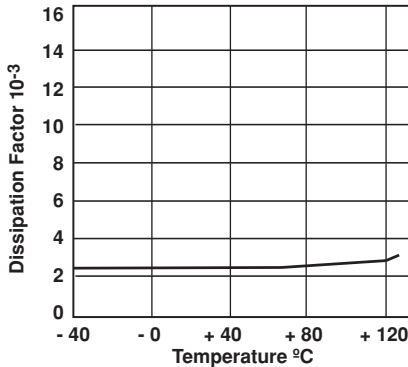


CAPACITANCE VS. TEMPERATURE

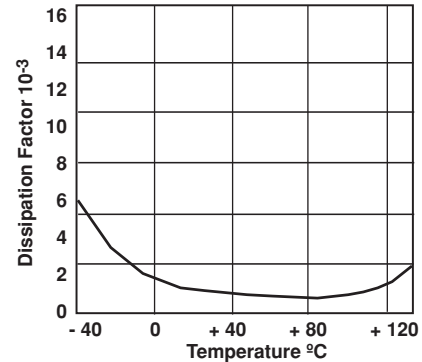
N 2200 CERAMIC



CAPACITANCE VS. TEMPERATURE



DISSIPATION FACTOR VS. TEMPERATURE



DISSIPATION FACTOR VS. TEMPERATURE

ORDERING CODE

Ordering code

□□□ 10th / 11th / 12th digit

Lead configuration (See appropriate pages)

Ceramic Pulse Disc Capacitors, Class 2

DESIGN:

Disc capacitor with epoxy coating

RATED VOLTAGE U_R :

HAK	1kV _{DC}
HBK	2kV _{DC}
HCK	3kV _{DC}
HIK	15kV _{DC}

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test

HAK	2000V _{AC} , 50Hz, 2s
HBK	3000V _{AC} , 50Hz, 2s
HCK	4000V _{AC} , 50Hz, 2s
HIK	22500V _{DC} , 2s

DISSIPATION FACTOR $\tan \delta$:

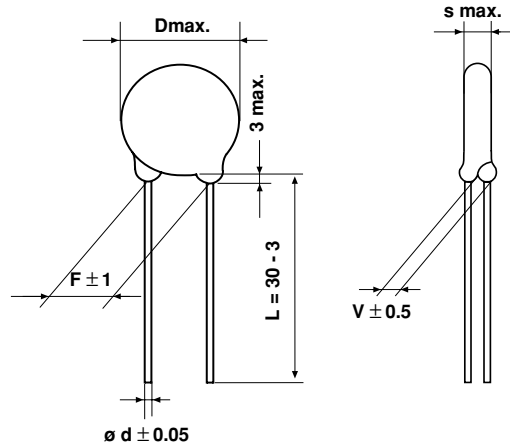
$\leq 5 \cdot 10^{-3}$

INSULATION RESISTANCE R_{IS} :

HAK, HBK, HCK	$\geq 10 \cdot 10^9 \Omega$
HIK	$\geq 10 \cdot 10^{10} \Omega$

MARKING:

Capacitance value	- Clear text
Capacitance tolerance	- With letter code
Rated voltage	- Clear text
Manufacturers logo	- Where $D \geq 11$ mm only



• Dimensions in mm

TEMPERATURE CHARACTERISTIC OF CAPACITANCE:

See curve below

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 40 to + 125°C)

CLIMATIC CATEGORY TO EN 60068-1:

40 / 125 / 21

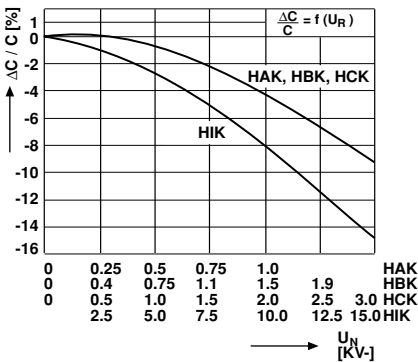
COATING:

Epoxy dipped, insulating,
Flame retarding acc. to UL 94V-0

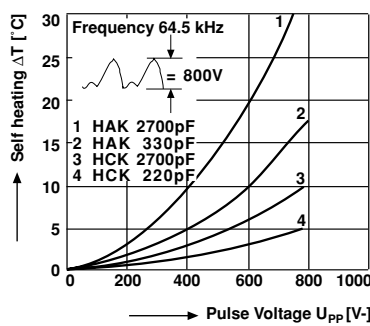
TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

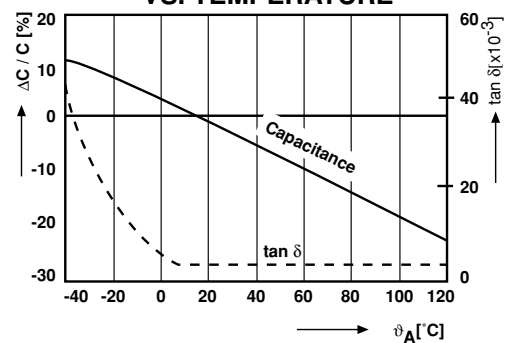
CAPACITANCE CHANGE VS. VOLTAGE



SELF HEATING



CAPACITANCE CHANGE AND DISSIPATION FACTOR VS. TEMPERATURE



ORDERING INFORMATION

HIK	471	M	BJ	EF0	K
MODEL	CAPACITANCE VALUE	TOLERANCE	RATED VOLTAGE	LEAD CONFIGURATION	INTERNAL CODE



CAP. VALUE (pF)	CERAMIC DIELECTRIC: K 1500 CAPACITANCE TOLERANCE: ± 20%, (± 10%)**				CERAMIC DIELECTRIC: K 1500 CAPACITANCE TOLERANCE: ± 20%, (± 10%)**					
	RATED VOLTAGE = 1kV _{DC}				RATED VOLTAGE = 2kV _{DC}					
	D x s (MAX) (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	D x s (MAX) (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE
100	7 x 5	7.5	0.6	1.1	HAK101□BA□□□K	7 x 5	7.5	0.6	1.6	HBK101□BF□□□K
150	7 x 5				HAK151□BA□□□K	7 x 5				HBK151□BF□□□K
220	7 x 5				HAK221□BA□□□K	7 x 5				HBK221□BF□□□K
270	7 x 5				HAK271□BA□□□K	7 x 5				HBK271□BF□□□K
330	7 x 5				HAK331□BA□□□K	7 x 5				HBK331□BF□□□K
390	7 x 5				HAK391□BA□□□K	8 x 5				HBK391□BF□□□K
470	7 x 5				HAK471□BA□□□K	8 x 5				HBK471□BF□□□K
560	8 x 5				HAK561□BA□□□K	9 x 5				HBK561□BF□□□K
680	8 x 5				HAK681□BA□□□K	9 x 5				HBK681□BF□□□K
820	9 x 5				HAK821□BA□□□K	10 x 5				HBK821□BF□□□K
1000	9 x 5				HAK102□BA□□□K	11 x 5				HBK102□BF□□□K
1200	10 x 5				HAK122□BA□□□K	11 x 5				HBK122□BF□□□K
1500	11 x 5				HAK152□BA□□□K	12.5 x 5				HBK152□BF□□□K
1800	12 x 5				HAK182□BA□□□K	14.5 x 5				HBK182□BF□□□K
2200	12 x 5				HAK222□BA□□□K	14.5 x 5				HBK222□BF□□□K
2700	14.5 x 5				HAK272□BA□□□K	16.5 x 5				HBK272□BF□□□K
3300	14.5 x 5				HAK332□BA□□□K	17.5 x 5				HBK332□BF□□□K
3900	15.5 x 5				HAK392□BA□□□K	19.5 x 5				HBK392□BF□□□K
4700	16.5 x 5				HAK472□BA□□□K	25 x 5				HBK472□BF□□□K
RATED VOLTAGE = 3kV _{DC}					RATED VOLTAGE = 15kV _{DC}					
100	7 x 5	10	0.6	1.6	HCK101□BC□□□K	8 x 8	12.5	0.8	5	HIK101□BJ□□□K
120	7 x 5				HCK121□BC□□□K	9 x 8				HIK121□BJ□□□K
150	7 x 5				HCK151□BC□□□K	9 x 8				HIK151□BJ□□□K
180	7 x 5				HCK181□BC□□□K	10 x 8				HIK181□BJ□□□K
220	7 x 5				HCK221□BC□□□K	10 x 8				HIK221□BJ□□□K
270	7 x 5				HCK271□BC□□□K	11 x 8				HIK271□BJ□□□K
330	8 x 5				HCK331□BC□□□K	11.5 x 8				HIK331□BJ□□□K
390	9 x 5				HCK391□BC□□□K	13 x 8.4				HIK391□BJ□□□K
470	9 x 5				HCK471□BC□□□K	15 x 8.4				HIK471□BJ□□□K
560	10 x 5				HCK561□BC□□□K	15 x 8.4				HIK561□BJ□□□K
680	10 x 5				HCK681□BC□□□K	16 x 8.4			HIK681□BJ□□□K	
820	11 x 5				HCK821□BC□□□K	18.5 x 8.4			HIK821□BJ□□□K	
1000	12 x 5				HCK102□BC□□□K	20 x 8.4			HIK102□BJ□□□K	
1200	13 x 5				HCK122□BC□□□K	24 x 9			HIK122□BJ□□□K	
1500	15 x 5				HCK152□BC□□□K	24 x 9			HIK152□BJ□□□K	
1800	16 x 5				HCK182□BC□□□K					
2200	17 x 5				HCK222□BC□□□K					
2700	18 x 5				HCK272□BC□□□K					
3300	20 x 5				HCK332□BC□□□K					

* Standard lead configuration, other than spacing and diameter available on request
 ** ± 10% available on request

ORDERING CODE		
Ordering code	□ 7th digit	Capacitance tolerance
	□□□ 10th / 11th / 12th digit	Lead configuration (See General Information)

Ceramic Pulse Disc Capacitors, Class 2

DESIGN:

Disc capacitor with epoxy coating

RATED VOLTAGE U_R :

2kV_{DC}

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test
3400V_{DC} 2s

DIELECTRIC STRENGTH OF BODY INSULATION:

2000V_{AC} 50Hz, 2s

SELF-HEATING (TYPICAL VALUES):

at 16 kHz, 1000V_{pp}, 166V/μs
 ≤ 470pF: max. 30°C
 ≤ 1000pF: max. 40°C
 > 1000pF: max. 45°C

DISSIPATION FACTOR $\tan \delta$:

≤ 20 • 10⁻³

INSULATION RESISTANCE R_{is} :

≥ 1 • 10¹⁰Ω

MARKING:

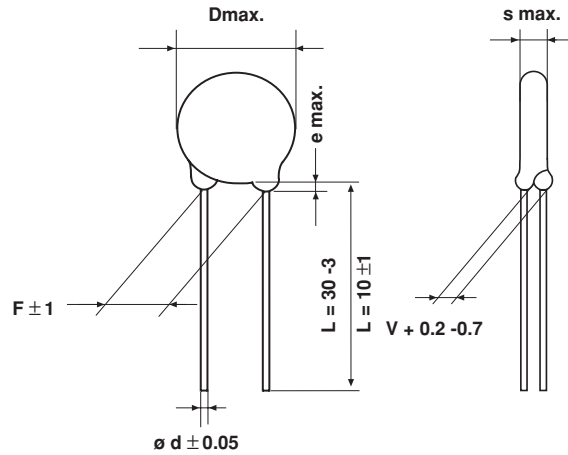
- Type designation - 1st three digits
- Capacitance value - Clear text
- Capacitance tolerance - With letter code
- Rated voltage - Clear text, IP (for pulse)
- Manufacturers logo - Where D ≥ 13mm only

TEMPERATURE CHARACTERISTICS OF CAPACITANCE:

See curves on next page.

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 40 to + 85°C)



• Dimensions in mm

CLIMATIC CATEGORY ACC. TO EN 60068-1:

40 / 085 / 21

COATING:

Epoxy dipped, insulating,
Flame retarding acc. to UL 94V-0

TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

TYPICAL APPLICATION:

These ceramic pulse capacitors are used to trim the flyback capacitor in television sets.

Various line terminations can be adapted in this way or various picture tubes can be used without the need to change the flyback capacitor. Apart from this application, i.e. in the line end stage and in the power supply, there are similar applications in monitor development.

ORDERING INFORMATION

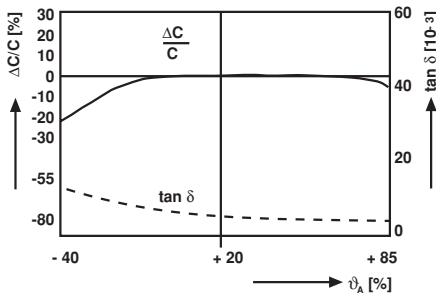
IBC	152	M	BB	CD0	K
MODEL	CAPACITANCE VALUE	TOLERANCE	RATED VOLTAGE	LEAD CONFIGURATION	INTERNAL CODE



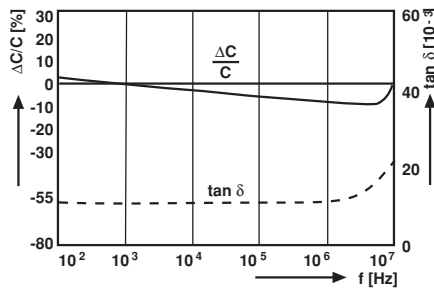
CERAMIC DIELECTRIC: K 2000 CERAMIC CODE: Z CAPACITANCE TOLERANCE: $\pm 20\%$ ($\pm 10\%$ available on request)						
RATED VOLTAGE = $2kV_{DC}$						
CAP. VALUE (pF)	D x s (MAX) (mm)	F $\pm 1^*$ (mm)	d $\pm 0.05^*$ (mm)	V $\pm 0.05^*$ (mm)	e max. (mm)	ORDERING CODE
100	7.0 x 5.0	7.5	0.6	2.1	3	IBC101MBB□□□K
120	7.0 x 5.0					IBC121MBB□□□K
150	7.0 x 5.0					IBC151MBB□□□K
180	7.0 x 6.0					IBC181MBB□□□K
220	9.0 x 5.0					IBC221MBB□□□K
270	9.0 x 5.5			2.6		IBC271MBB□□□K
330	9.0 x 5.5					IBC331MBB□□□K
390	13.0 x 6.0					IBC391MBB□□□K
470	13.0 x 6.0					IBC471MBB□□□K
560	17.0 x 6.0					3.4
680	17.0 x 6.0			IBC681MBB□□□K		
820	17.0 x 6.0			IBC821MBB□□□K		
1000	17.0 x 6.0			IBC102MBB□□□K		
1200	19.0 x 6.0			0.8	IBC122MBB□□□K	
1500	19.0 x 6.0				IBC152MBB□□□K	

*Standard lead configuration, other lead spacing and diameter available on request

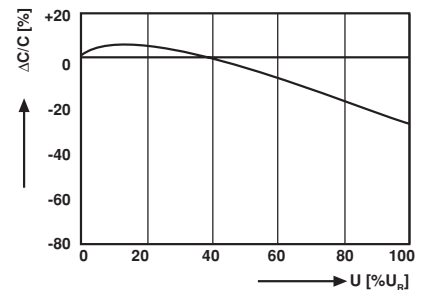
CAPACITANCE CHANGE & DISSIPATION FACTOR VS. TEMPERATURE



CAPACITANCE CHANGE & DISSIPATION FACTOR VS. FREQUENCY



CAPACITANCE CHANGE VS. VOLTAGE



ORDERING CODE

Ordering code

□□□ 10th / 11th / 12th digit

Lead configuration (See General Information)



Ceramic AC Capacitors Safety Standard Approved

SERIES	DESIGN	U_R	CAPACITANCE RANGE	PAGE
W1X	Ceramic Suppression Capacitors Class X1	275V _{AC}	4700pF to 0.022μF	42
WYO	Ceramic AC Capacitors Safety Standard Approved Class X1 Class Y2	440V _{AC} 250V _{AC}	1000pF to 0.012μF	44
VKO	Ceramic AC Capacitors Safety Standard Approved Class X1 Class Y2	440V _{AC} 300V _{AC}	1000pF to 4700pF	46
WKO	Ceramic AC Capacitors Safety Standard Approved Class X1 Class Y2	440V _{AC} 300V _{AC}	33pF to 4700pF	48
VKP	Ceramic AC Capacitors Safety Standard Approved Class X1 Class Y1	760V _{AC} 500V _{AC}	47pF to 4700pF	50
WKP	Ceramic AC Capacitors Safety Standard Approved Class X1 Class Y1	760V _{AC} 500V _{AC}	33pF to 4700pF	52

Ceramic Disc Capacitors Class X1, 275V_{AC}

DESIGN:

Disc capacitors with epoxy coating

RATED VOLTAGE U_R:

(X1): 275V_{AC}, 50Hz (IEC 60384-14.2)

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test:

4000V_{AC}, 50Hz, 2s

As repeated test admissible only once with

3600V_{AC}, 50Hz, 2s

Random sampling test (destructive test):

3500V_{AC}, 50Hz, 60s

DIELECTRIC STRENGTH OF BODY INSULATION:

2000V_{AC}, 50Hz, 60s (destructive test)

DISSIPATION FACTOR tan δ:

≤ 25 · 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 6 · 10⁹Ω

CATEGORY TEMPERATURE RANGE θ_A:

(- 40 to + 125)°C

CLIMATIC CATEGORY ACC. TO EN60068-1:

40/125/21

COATING:

Epoxy dipped, insulating, flame retarding acc. to UL 94V-0

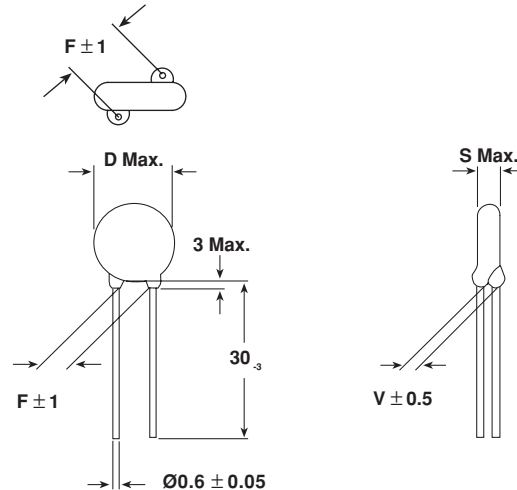
TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

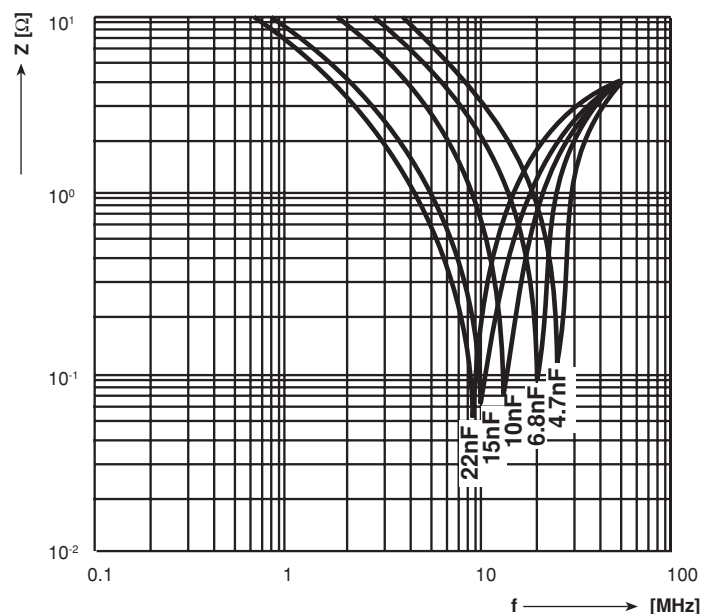
MARKING:



All approved marks are also shown on the label.



• Dimensions in mm



Impedance (Z) as a function of frequency (f) at T_a = 20°C (average).

Measurement with lead length 6mm.



CAPACITANCE pF	D x s Max. (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	CERAMIC DIELECTRIC
4700 pF	11.0 x 3.0	7.5	0.6	1.4	W1X472□CV□□□K	K 10000
6800 pF	11.0 x 3.0				W1X682□CV□□□K	
0.010 μF	15.0 x 3.0				W1X103□CV□□□K	
0.015 μF	17.0 x 3.0			1.6	W1X153□CV□□□K	
0.022 μF	20.0 x 3.0			W1X223□CV□□□K		

*Standard lead configuration, other lead spacing and diameter available on request

Capacitance Tolerances: ± 20%, (+ 50 - 20%)

Ordering Code:	<input type="checkbox"/> 7th digit:	Capacitance tolerance:	± 20% = M + 50- 20% = S
	<input type="checkbox"/> 10th/11th/12th digit:	Lead configuration (See General Information)	

APPROVALS			
IEC 60384-14 2ND Edition (1993) Table II & A 1 (1995-06) EN 132400 (1994) These approvals together with the CB-Test Certificate substitutes the national approval of the nations given in the table below	(X1) CB-Test Certificate	Fi 362 A 2 (275V _{AC})	
	(X1) CB-Test Certificate	DE 1-7467 (275V _{AC})	

This approval mark together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the CB-Agreement):

Austria	Belgium	Denmark	Finland	Sweden
France	Germany	Ireland	Italy	Switzerland
Netherlands	Israel	Portugal	Spain	Great Britain
Japan	Norway	China	Poland	Czech. Republic
Singapore	Rep. of Korea	Hungary	Iceland	Slovenia

ORDERING INFORMATION:					
W1X SERIES	223 CAP. VALUE	M TOLERANCE	CV RATED VOLTAGE	CF0 LEAD CONFIGURATION	K INTERNAL CODE

Ceramic AC Capacitors

Class X1, 440V_{AC} / Class Y2, 250V_{AC}

DESIGN:

Disc capacitors with epoxy coating

RATED VOLTAGE U_R:

(X1): 440V_{AC}, 50Hz (IEC 60384-14.2)
 (Y2): 250V_{AC}, 50Hz (IEC 60384-14.2)
 250V_{AC}, 60Hz (UL1414, CSA C22.2)

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test:
 2200V_{AC}, 50Hz, 2s
 As repeated test admissible only once with
 2000V_{AC}, 50Hz, 2s
 Random sampling test (destructive test):
 1500V_{AC}, 50Hz, 60s

DIELECTRIC STRENGTH OF BODY INSULATION:

2000V_{AC}, 50Hz, 60s (destructive test)

DISSIPATION FACTOR tan δ:

≤ 25 · 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 6 · 10⁹Ω

CATEGORY TEMPERATURE RANGE ϑ_A:

(- 40 to + 125)°C

CLIMATIC CATEGORY ACC. TO EN60068-1:

40/125/21

COATING:

Epoxy, dipped, insulating, flame retarding acc. to
 UL 94V-0

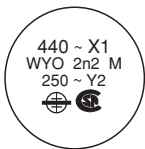
TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

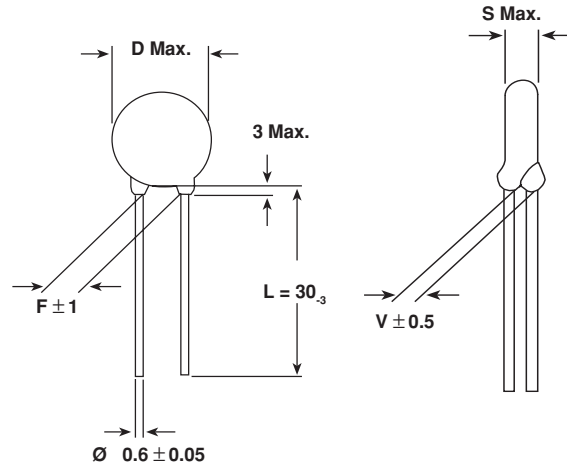
MARKING:

D ≤ 9mm

D ≥ 10mm

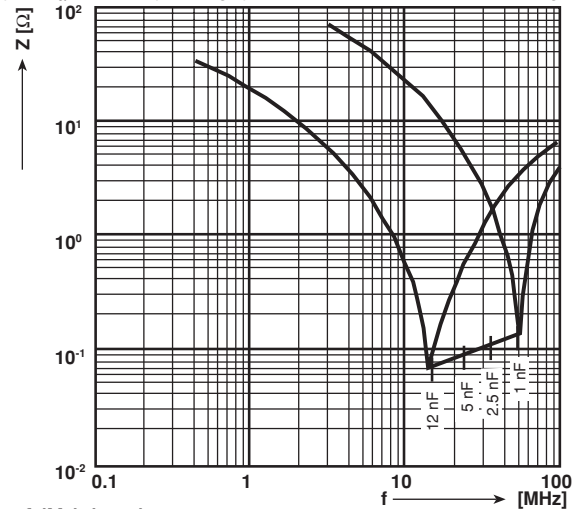


All approval marks are also shown on the label.

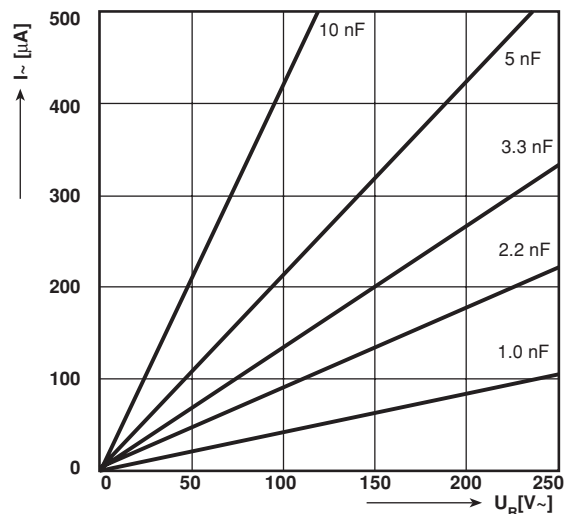


• Dimensions in mm

Impedance (Z) as a function of frequency (f) at T_a = 20°C (average). Measurement with lead length 6mm.



I = f (U_R) (typ.)





Ceramic AC Capacitors Class X1, 440V_{AC} / Class Y2, 250V_{AC} Vishay Draloric

CAPACITANCE (pF)	D x s Max. (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	CERAMIC DIELECTRIC	
1000	6.5 x 4.5	5	0.6	1.4	WYO102□CM□□□K	K 4000	
1500	8.0 x 4.5				WYO152□CM□□□K		
1800	8.0 x 4.5				WYO182□CM□□□K		
2200	9.0 x 4.5				WYO222□CM□□□K		
2500	9.0 x 4.5				WYO252□CM□□□K		
3300	10.0 x 4.5	7.5		1.4	WYO332□CM□□□K		
4700	12.0 x 4.5				WYO472□CM□□□K		
5000	12.0 x 4.5				WYO502□CM□□□K		
6800	17.0 x 4.5				1.6		WYO682□CM□□□K
8200	17.0 x 4.5						WYO822□CM□□□K
0.010μF	21.0 x 4.5		WYO103□CM□□□K				
0.012μF	21.0 x 4.5		WYO123□CM□□□K				

*Standard lead configuration, other lead spacing and diameter available on request.

Capacitance Tolerances: ± 20%

Ordering Code:	<input type="checkbox"/> 7th digit:	Capacitance tolerance:	± 20% = M
	<input type="checkbox"/> 10th/11th/12th digit:	Lead configuration (See General Information)	

APPROVALS			
IEC 60384-14 2ND edition (1993) Table II & A 1 (1995-06)	(Y2) CB-Test Certificate (X1) CB-Test Certificate	Fi 585 A 1 (250V _{AC}) Fi 508 A 2 (440V _{AC})	
EN 132400 (1994) These approvals together with the CB-Test Certificate substitutes the national approval of the nations given in the table below	(Y2) CB-Test Certificate (X1) CB-Test Certificate	DE 1-8789 (250V _{AC}) DE 1-8789 (440V _{AC})	
UL 1414	Line-by-pass & Antenna coupling capacitor	E 183844 V1 S2 (250V _{AC})	
CSA C22.2 No. 1-M1981	Across-the-line, line-to-ground and antenna isolation capacitor	LR 64546-10 (250V _{AC})	

This approval mark together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the CB-Agreement):

Austria	Belgium	Denmark	Finland	Sweden
France	Germany	Ireland	Italy	Switzerland
Netherlands	Israel	Portugal	Spain	Great Britain
Japan	Norway	China	Poland	Czech. Republic
Singapore	Rep. of Korea	Hungary	Iceland	Slovenia

ORDERING INFORMATION					
WYO SERIES	103 CAP. VALUE	M TOLERANCE	CM RATED VOLTAGE	CF0 LEAD CONFIGURATION	K INTERNAL CODE

Ceramic AC Capacitors

Class X1, 440V_{AC} / Class Y2, 300V_{AC}

DESIGN:

Disc capacitors with epoxy coating

RATED VOLTAGE U_R:

(X1): 440V_{AC}, 50Hz (IEC 60384-14.2)
 (Y2): 300V_{AC}, 50Hz (IEC 60384-14.2)
 250V_{AC}, 60Hz (UL1414, CSA C22.2)

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test:
 2600V_{AC}, 50Hz, 2s
 As repeated test admissible only once with
 2340V_{AC}, 50Hz, 2s
 Random sampling test (destructive test):
 2600V_{AC}, 50Hz, 60s

DIELECTRIC STRENGTH OF BODY INSULATION:

2600V_{AC}, 50Hz, 60s (destructive test)

DISSIPATION FACTOR tan δ:

≤ 25 · 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 6 · 10⁹Ω

CATEGORY TEMPERATURE RANGE θ_A:

(- 40 to +125)°C

CLIMATIC CATEGORY ACC. TO EN60068-1:

40/125/21

COATING:

Epoxy, dipped, insulating, flame retarding acc. to
 UL 94V-0

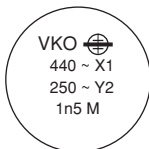
TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

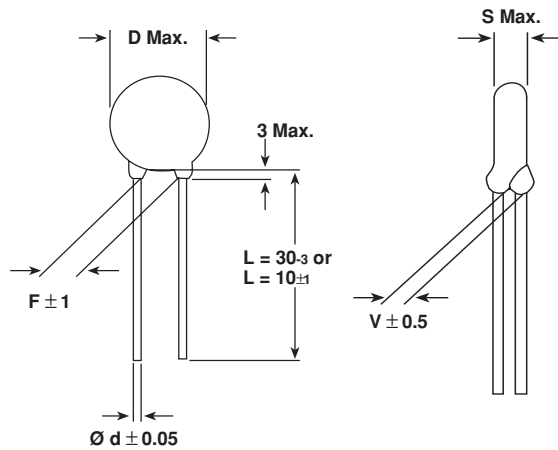
MARKING:

D ≤ 9mm

D ≥ 10mm



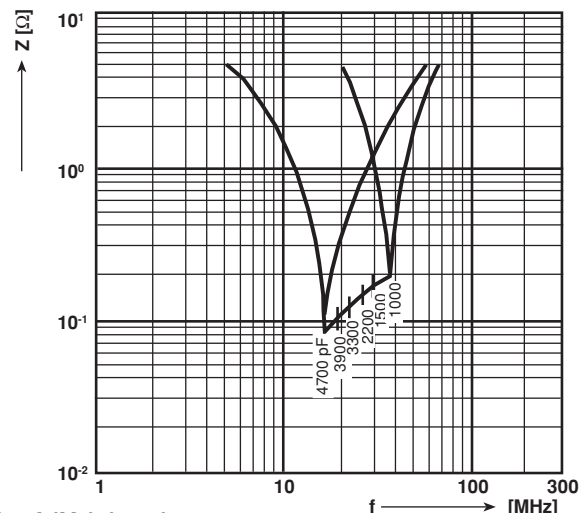
All approval marks are also shown on the label.



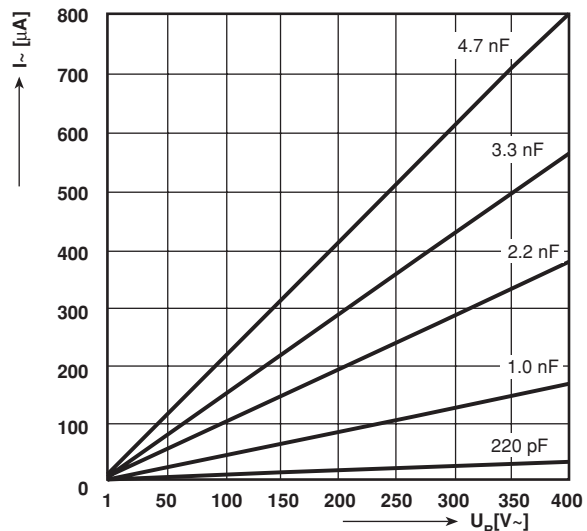
• Dimensions in mm

Impedance (Z) as a function of frequency

(f) at T_a = 20°C (average). Measurement with lead length 50mm.



I = f (U_R) (typ.)





CAPACITANCE (pF)	D x s Max. (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	CERAMIC DIELECTRIC
1000	7.0 x 4.5	7.5	0.6	1.6	VKO102□CQ□□□K	K 6000
1500	8.0 x 4.5				VKO152□CQ□□□K	
2200	10.0 x 4.5				VKO222□CQ□□□K	
3300	11.5 x 4.5				VKO332□CQ□□□K	
3900	14.0 x 4.5				VKO392□CQ□□□K	
4700	14.0 x 4.5				VKO472□CQ□□□K	

*Standard lead configuration, other lead spacing and diameter available on request.

Capacitance Tolerances: ± 10%, ± 20%

Ordering Code:	<input type="checkbox"/> 7th digit:	Capacitance tolerance:	± 10% = K ± 20% = M
	<input type="checkbox"/> 10th/11th/12th digit:	Lead configuration (See General Information)	

APPROVALS			
IEC 60384-14 2ND edition (1993) Table II & A 1 (1995-06)	(Y2) CB-Test Certificate (X1) CB-Test Certificate	Fi 675 A 2 (250V _{AC}) Fi 674 A 1 (440V _{AC})	
EN 132400 (1994) These approvals together with the CB-Test Certificate substitutes the national approval of the nations given in the table below	(Y2) CB-Test Certificate (X1) CB-Test Certificate	DE 1-7466 (300V _{AC}) DE 1-7466 (440V _{AC})	
UL 1414	Line-by-pass capacitor	E 183844 V1 S6 (250V _{AC})	
CSA C22.2 No. 1-M90	Antenna and line isolation capacitor	LR 64546-9 (250V _{AC})	

This approval mark together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the CB-Agreement):				
Austria	Belgium	Denmark	Finland	Sweden
France	Germany	Ireland	Italy	Switzerland
Netherlands	Israel	Portugal	Spain	Great Britain
Japan	Norway	China	Poland	Czech. Republic
Singapore	Rep. of Korea	Hungary	Iceland	Slovenia

ORDERING INFORMATION					
VKP SERIES	102 CAP. VALUE	M TOLERANCE	CQ RATED VOLTAGE	ED0 LEAD CONFIGURATION	K INTERNAL CODE

Ceramic AC Capacitors

Class X1, 440V_{AC} / Class Y2, 300V_{AC}

DESIGN:

Disc capacitors with epoxy coating

RATED VOLTAGE U_R:

(X1): 440V_{AC}, 50Hz (IEC 60384-14.2)
 (Y2): 300V_{AC}, 50Hz (IEC 60384-14.2)
 250V_{AC}, 60Hz (UL1414, CSA C22.2)

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test:
 2600V_{DC}, 50Hz, 2s
 As repeated test admissible only once with
 2340V_{AC}, 50Hz, 2s
 Random sampling test (destructive test):
 2600V_{AC}, 50Hz, 60s

DIELECTRIC STRENGTH OF BODY INSULATION:

2600V_{AC}, 50Hz, 60s (destructive test)

DISSIPATION FACTOR tan δ:

≤ 25 · 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 6 · 10⁹Ω

CATEGORY TEMPERATURE RANGE ϑ_A:

(- 40 to +125)°C

CLIMATIC CATEGORY ACC. TO EN60068-1:

40/125/21

COATING:

Epoxy, dipped, insulating, flame retarding acc. to
 UL 94V-0

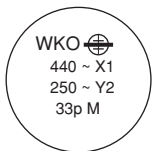
TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

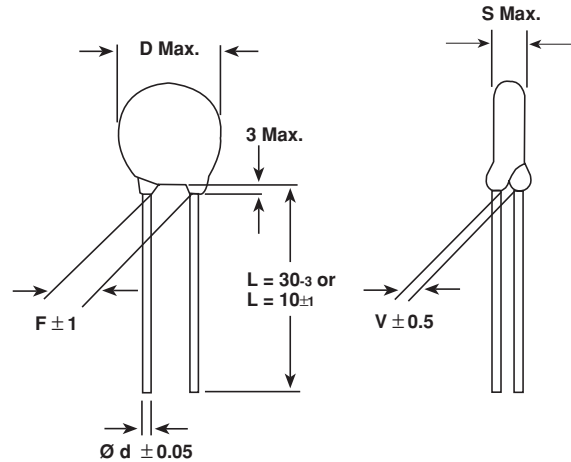
MARKING:

D ≤ 9mm

D ≥ 10mm

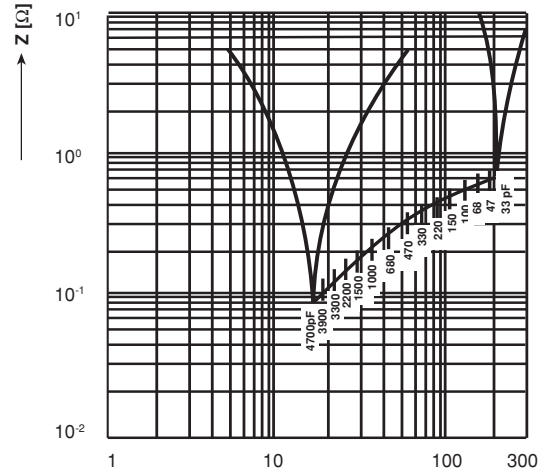


All approval marks are also shown on the label.

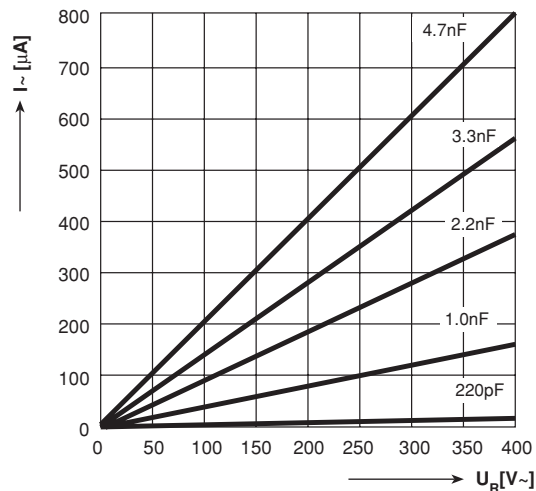


• Dimensions in mm

Impedance (Z) as a function of frequency (f) at T_a = 20°C (average). Measurement with lead length 50mm.



I = f (U_R) (typ.)





CAPACITANCE (pF)	D x s Max. (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	CERAMIC DIELECTRIC
33	7.0 x 4.5	7.5	0.6	1.6	WKO330□CP□□□K	N 750
47	7.0 x 4.5				WKO470□CP□□□K	
68	7.0 x 4.5			1.9	WKO680□CP□□□K	K 1200
100	7.0 x 4.5				WKO101□CP□□□K	K 1500
150	7.0 x 4.5				WKO151□CP□□□K	K 2000
220	7.0 x 4.5				WKO221□CP□□□K	
330	7.0 x 4.5				WKO331□CP□□□K	
470	7.0 x 4.5				WKO471□CP□□□K	K 4000
680	9.0 x 5.0			2.0	WKO681□CP□□□K	
1000	9.0 x 5.0			0.8	WKO102□CP□□□K	
1500	10.0 x 5.0				WKO152□CP□□□K	
2200	12.0 x 5.0				WKO222□CP□□□K	
3300	13.0 x 5.0				WKO332□CP□□□K	
3900	14.5 x 5.0				WKO392□CP□□□K	
4700	14.5 x 5.0	WKO472□CP□□□K				
		12.5				

*Standard lead configuration, other lead spacing and diameter available on request

Capacitance Tolerances: ± 10%, ± 20%

Ordering Code:	<input type="checkbox"/> 7th digit:	Capacitance tolerance:	± 10% = K ± 20% = M
	<input type="checkbox"/> 10th/11th/12th digit:	Lead configuration (See General Information)	

APPROVALS			
IEC 60384-14 2nd Edition (1993) Table II & A 1 (1995-06)	(Y2) CB-Test Certificate (X1) CB-Test Certificate	Fi 338A 2 (250V _{AC}) Fi 435 A 1 (440V _{AC})	
EN 132400 (1994) These approvals together with the CB-Test Certificate substitutes the national approval of the nations given in the table below	(Y2) CB-Test Certificate (X1) CB-Test Certificate	DE 1-7465 (300V _{AC}) DE 1-7465 (440V _{AC})	
UL 1414	Across-the-line, line to ground antenna-coupling and line-by-pass capacitor	E 183844 V1 S2 (250V _{AC})	
CSA C22.2 No. 1-M1981	33pF to 1500pF: Across-the-line, line-to-ground and antenna isolation capacitor 2200pF to 4700pF: Antenna and line isolation capacitor	LR 64546-10 (250V _{AC})	

This approval mark together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the CB-Agreement):				
Austria	Belgium	Denmark	Finland	Sweden
France	Germany	Ireland	Italy	Switzerland
Netherlands	Israel	Portugal	Spain	Great Britain
Japan	Norway	China	Poland	Czech. Republic
Singapore	Rep. of Korea	Hungary	Iceland	Slovenia

Ceramic AC Capacitors

Class X1, 760V_{AC} / Class Y1, 500V_{AC}

DESIGN:

Disc capacitors with epoxy coating

RATED VOLTAGE U_R:

(X1): 760V_{AC}, 50Hz (IEC 60384-14.2)
 (Y1): 500V_{AC}, 50Hz (IEC 60384-14.2)
 250V_{AC}, 60Hz (UL1414, CSA C22.2)

DIELECTRIC STRENGTH BETWEEN LEADS:

Component test:
 4000V_{AC}, 50Hz, 2s
 As repeated test admissible only once with
 3600V_{AC}, 50Hz, 2s
 Random sampling test (destructive test):
 4000V_{AC}, 50Hz, 60S

DIELECTRIC STRENGTH OF BODY INSULATION:

4000V_{AC}, 50Hz, 60s (destructive test)

DISSIPATION FACTOR tan δ:

≤ 25 · 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 10 · 10⁹Ω

CATEGORY TEMPERATURE RANGE ϑ_A:

(- 40 to +125)°C

CLIMATIC CATEGORY ACC. TO EN60068-1:

40/125/21

COATING:

Epoxy dipped, insulating, flame retarding acc. to UL 94V-0

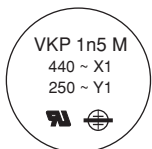
TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

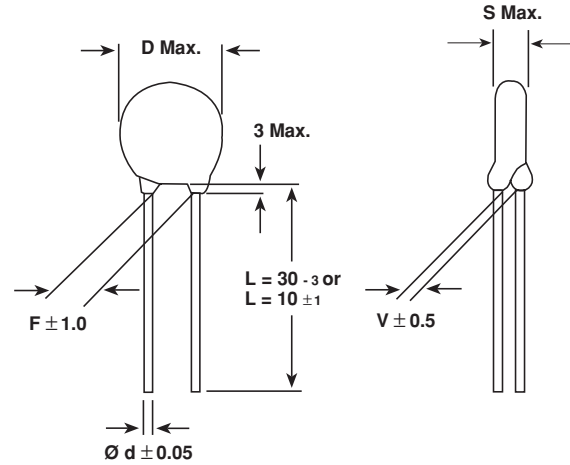
MARKING:

D ≤ 9mm

D ≥ 10mm

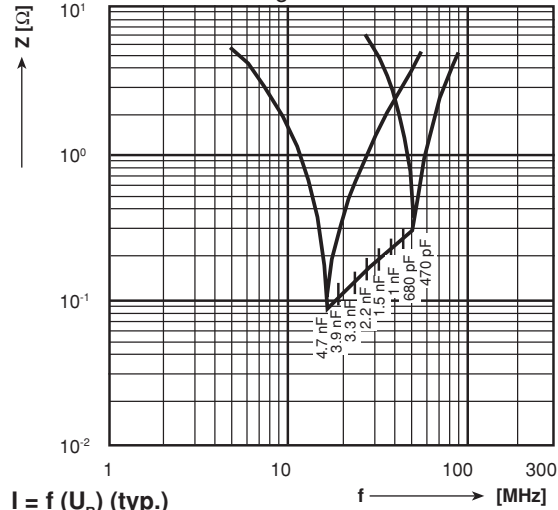


All approval marks are also shown on the label.

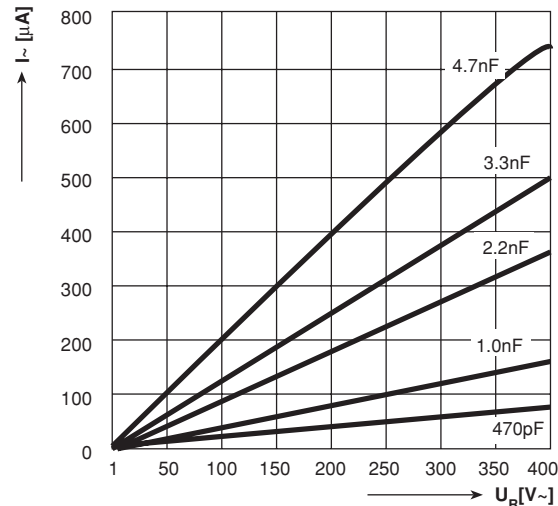


• Dimensions in mm

Impedance (Z) as a function of frequency (f) at T_a = 20°C (average).
 Measurement with lead length 6mm.



I = f (U_R) (typ.)





CAPACITANCE (pF)	D x s Max. (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	CERAMIC DIELECTRIC
470	8.0 x 5.0	12.5	0.6	2.1	VKP471□CQ□□□K	K 4000
680	8.0 x 5.0		VKP681□CQ□□□K			
1000	9.0 x 5.0		VKP102□CQ□□□K			
1500	10.0 x 5.0		VKP152□CQ□□□K			
2200	12.0 x 5.0		VKP222□CQ□□□K			
2700	13.0 x 5.0		VKP272□CQ□□□K			
3300	15.0 x 5.0		VKP332□CQ□□□K			
3900	15.0 x 5.0		VKP392□CQ□□□K			
4700	17.0 x 5.0		VKP472□CQ□□□K			

*Standard lead configuration, other lead spacing and diameter available on request.

Capacitance Tolerances: ± 10%, ± 20%

Ordering Code:	<input type="checkbox"/> 7th digit:	Capacitance tolerance:	± 10% = K ± 20% = M
	<input type="checkbox"/> 10th/11th/12th digit:	Lead configuration (See General Information)	

APPROVALS			
IEC 60384-14 2ND edition (1993) Table II & A 1 (1995-06) EN 132400 (1994) These approvals together with the CB-Test Certificate substitutes the national approval of the nations given in the table below	(Y1) CB-Test Certificate (X1) CB-Test Certificate	Fi 492 A 2 (250V _{AC}) Fi 491 A 2 (440V _{AC})	
	(Y1) CB-Test Certificate (X1) CB-Test Certificate	DE 1-7461 (500V _{AC}) DE 1-7461 (760V _{AC})	
UL 1414	Across-the-line, antenna coupling and line-by-pass capacitor	E 183844 V1 S5 (250V _{AC})	
CSA C22.2 No. 1-94	Across-the-line, line-to-ground and antenna isolation capacitor	LR 64546-12 (250V _{AC}) E 183844 V1 S5 (250V _{AC})	

This approval mark together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the CB-Agreement):

Austria	Belgium	Denmark	Finland	Sweden
France	Germany	Ireland	Italy	Switzerland
Netherlands	Israel	Portugal	Spain	Great Britain
Japan	Norway	China	Poland	Czech. Republic
Singapore	Rep. of Korea	Hungary	Iceland	Slovenia

ORDERING INFORMATION					
VKP SERIES	102 CAP. VALUE	M TOLERANCE	CQ RATED VOLTAGE	EDO LEAD CONFIGURATION	K INTERNAL CODE

Ceramic AC Capacitors

Class X1, 760V_{AC} / Class Y1, 500V_{AC}

DESIGN:

Disc capacitors with epoxy coating

RATED VOLTAGE U_R:

- (X1): 760V_{AC}, 50Hz (IEC 60384-14.2)
- (Y1): 500V_{AC}, 50Hz (IEC 60384-14.2)
- 250V_{AC}, 60Hz (UL1414, CSA C22.2)

DIELECTRIC STRENGTH BETWEEN LEADS:

- Component test:
- 4000V_{AC}, 50Hz, 2s
- As repeated test admissible only once with
- 3600V_{AC}, 50Hz, 2s
- Random sampling test (destructive test):
- 4000V_{AC}, 50Hz, 60s

DIELECTRIC STRENGTH OF BODY INSULATION:

4000V_{AC}, 50Hz, 60s (destructive test)

DISSIPATION FACTOR tan δ:

≤ 25 • 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 10 • 10⁹Ω

CATEGORY TEMPERATURE RANGE ϑ_A:

(- 40 to +125)°C

CLIMATIC CATEGORY ACC. TO EN60068-1:

40/125/21

COATING:

Epoxy dipped, insulating, flame retarding acc. to UL 94V-0

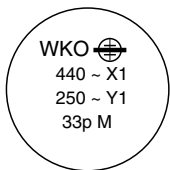
TAPING AND SPECIAL LEAD CONFIGURATIONS:

On request

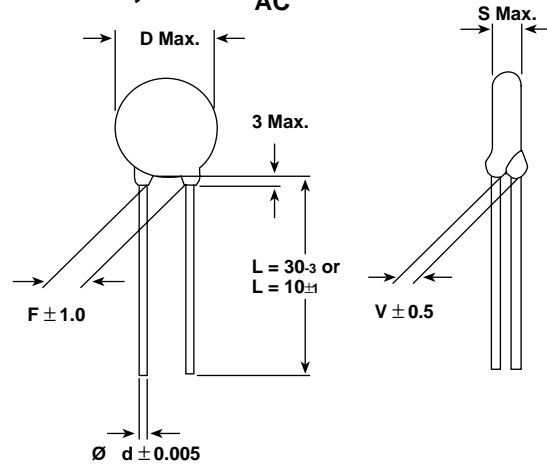
MARKING:

D ≤ 9mm

D ≥ 10mm

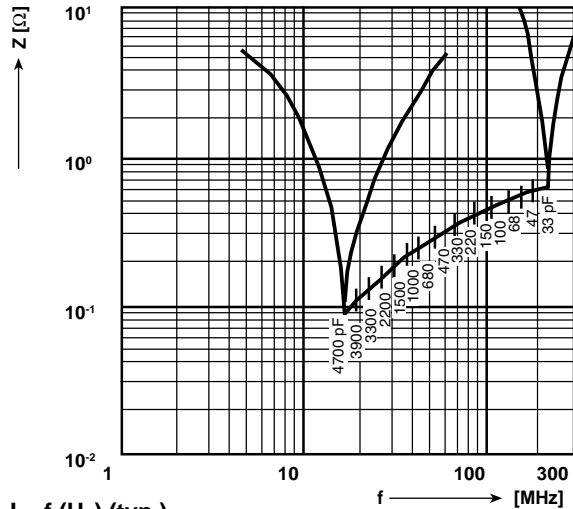


All approval marks are also shown on the label.

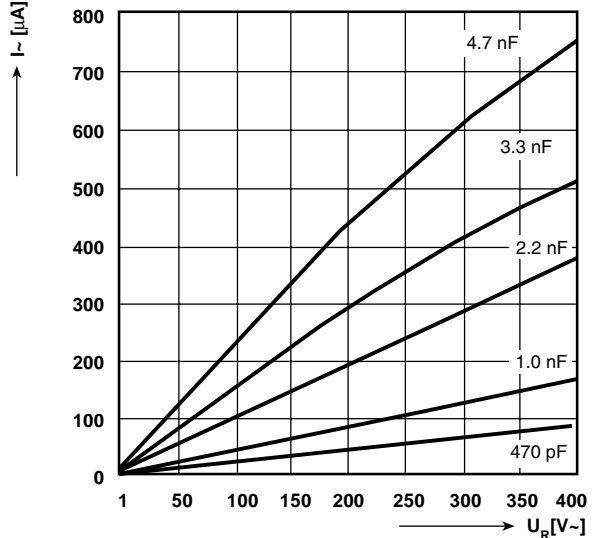


• Dimensions in mm

Impedance (Z) as a function of frequency (f) at T_a = 20°C (average). Measurement with lead length 6mm.



I = f (U_R) (typ.)





CAPACITANCE (pF)	D x s Max. (mm)	F ± 1* (mm)	d ± 0.05* (mm)	V ± 0.5* (mm)	ORDERING CODE	CERAMIC DIELECTRIC	
33	8.0 x 6.0	12.5	0.6	1.9	WKP330□CP□□□K	N 750	
47	8.0 x 6.0			2.3		WKP470□CP□□□K	K 1200
68	8.0 x 6.0					WKP680□CP□□□K	
100	8.0 x 6.0					WKP101□CP□□□K	K 1500
150	8.0 x 6.0			2.5		WKP151□CP□□□K	K 2000
220	8.0 x 6.0					WKP221□CP□□□K	
330	8.0 x 6.0				WKP331□CP□□□K	K 4000	
470	8.0 x 6.0		0.8	2.7	WKP471□CP□□□K		
680	9.0 x 6.0				WKP681□CP□□□K		
1000	10.0 x 6.0				WKP102□CP□□□K		
1500	12.0 x 6.0		WKP152□CP□□□K				
2200	13.0 x 6.0		WKP222□CP□□□K				
3300	15.0 x 6.0		WKP332□CP□□□K				
3900	16.0 x 6.0		WKP392□CP□□□K				
4700	18.0 x 6.0		WKP472□CP□□□K				

*Standard lead configuration, other lead spacing and diameter available on request.

Capacitance Tolerances: ± 10%, ± 20%

Ordering Code:	<input type="checkbox"/> 7th digit:	Capacitance tolerance:	± 10% = K ± 20% = M
	<input type="checkbox"/> 10th/11th/12th digit:	Lead configuration (See General Information)	

APPROVALS			
IEC 60384-14 2ND edition (1993) Table II & A 1 (1995-06)	(Y1) CB-Test Certificate (X1) CB-Test Certificate	Fi 336A 2 (250V _{AC}) Fi 436A 1 (440V _{AC})	
EN 132400 (1994) These approvals together with the CB-Test Certificate substitutes the national approval of the nations given in the table below	(Y1) CB-Test Certificate (X1) CB-Test Certificate	DE 1-8208 (500V _{AC}) DE 1-8208 (760V _{AC})	
UL 1414	Across-the-line antenna-coupling and line-by-pass capacitor	E 183844 V1 S1 (250V _{AC})	
CSA C22.2 No. 1-M1981	Across-the-line, line-to-ground and antenna isolation capacitor	LR 64546-2 (250V _{AC})	

This approval mark together with the CB-Certificate replace all national approval marks of the following countries (they have already signed the CB-Agreement):				
Austria	Belgium	Denmark	Finland	Sweden
France	Germany	Ireland	Italy	Switzerland
Netherlands	Israel	Portugal	Spain	Great Britain
Japan	Norway	China	Poland	Czech. Republic
Singapore	Rep. of Korea	Hungary	Iceland	Slovenia



Singlelayer Ceramic Capacitors

TUBULAR CERAMIC CAPACITORS

General Information	56
Ceramic Tubular Capacitors Class 1 & Class 2	74
Tubular Capacitor Sets	81

CERAMIC FEED-THROUGH & FILTER CAPACITORS

General Information	84
Ceramic Feed-Through Capacitors	85
Ceramic Feed-Through Filters	91

CERAMIC CAPACITOR STACKS & VOLTAGE MULTIPLIER SETS

General Information	99
Ceramic Capacitor Stacks.....	100
Voltage Multiplier Sets	103



Ceramic Singlelayer Capacitors

In accordance with IEC recommendations ceramic capacitors are subdivided into two classes:

- CERAMIC CLASS 1 or low-K capacitors are mainly manufactured of titanium dioxide or magnesium silicate
- CERAMIC CLASS 2 or high-K capacitors contain mostly alkaline titanates

MAIN FEATURES		
	CLASS 1	CLASS 2
APPLICATION	For temperature compensation of frequency discriminating circuits and filters, coupling and decoupling in high-frequency circuits where low losses and narrow capacitance tolerances are demanded. As RFI and safety capacitors.	As coupling and decoupling capacitors for such application where higher losses and a reduced capacitance stability are required. As RFI and safety capacitors
PROPERTIES Temperature Dependence Capacitance	High stability of capacitance. Low dissipation factor up to higher frequencies. Defined temperature coefficient of capacitance, positive or negative, linear and reversible. High insulation resistance. No voltage dependence. High long-term stability of electrical values.	High capacitance values with small dimensions. Non-linear dependence of capacitance on temperature.
DC VOLTAGE CAPACITANCE DEPENDENCE	None	Increasing with ϵ
DISSIPATION FACTOR $\tan \delta$	max. $1.5 \cdot 10^{-3}$ (Typical)	max. $25 \cdot 10^{-3}$ (Typical)
INSULATION RESISTANCE	$\geq 1 \cdot 10^{10}$ Ohm	$\geq 5 \cdot 10^9$ Ohm
CAPACITANCE TOLERANCES	<p>< 10pF: ± 0.1pF ± 0.25pF ± 0.5pF ± 1pF ± 2pF</p> <p>≥ 10pF: $\pm 1\%$ $\pm 2\%$ $\pm 2.5\%$ $\pm 5\%$ $\pm 10\%$ $\pm 20\%$</p> <p>With very low tolerances (<0.25pF) and where the customer does not exchange reference samples our capacitance standards are binding.</p>	<p>$\pm 10\%$ $\pm 20\%$ $- 20\% + 30\%$ $- 20\% + 50\%$ $- 20\% + 80\%$</p>
RATED VOLTAGE	125V _{DC} ... 700 _{DC}	125V _{DC} ... 700 _{DC} Capacitor stacks up to 19kV _{PEAK}



PREFERRED VALUES OF CAPACITANCE:

Nominal value series according to IEC 60063 see table on page 3 of this catalog.

The figures given in the table and their decimal multiples or sub-multiples are series or preferred values of capacitance.

CAPACITANCE MEASUREMENTS

The capacitance of all our single-layer capacitors - except where deviations are agreed upon in the ordering procedure - are measured under the following conditions.

MEASURING FREQUENCY

Class 1 capacitors: $(1 \pm 0.2)\text{MHz}$ or $(100 \pm 20)\text{kHz}$

Class 2 capacitors: $(1 \pm 0.2)\text{kHz}$ (Field strength max. $3V_{\text{RMS}}$ per millimeter)

MEASURING VOLTAGE

Class 1 capacitors: $\leq 5.0V_{\text{RMS}}$

Class 2 capacitors: $\leq 1.2V_{\text{RMS}}$

CLIMATIC CONDITIONS OF MEASUREMENTS

Temperature: $(23 \pm 3) \text{ C}$, for reference measurements $(20 \pm 1) \text{ C}$.

Relative humidity: $\leq 75\%$

REFERENCE LENGTH OF THE LEADS

2 millimeters from capacitor body. (These conditions are in accordance with IEC - publ. 60384-8, 60384-9)

TEMPERATURE COEFFICIENT OF CLASS 1 CAPACITORS

For cases of practical application requiring a defined and reproducible temperature dependence of capacitance, specific ceramic capacitor materials have been developed with which it is possible to achieve capacitance temperature coefficients (α_c) ranging between $+100$ to $-5600 \cdot 10^{-6}/^\circ\text{C}$.

Our ceramic materials are manufactured in accordance with the standard values of Class 1 (NDK).

The α_c rated values are determined by capacitance measurements at temperatures of $+20 \text{ C}$ and $+85 \text{ C}$ using the following formula below :

$$\alpha_c = \frac{C_2 - C_1}{C_1 \cdot (\delta_2 - \delta_1)}$$

C_1 = capacitance value in pF at 20 C
 C_2 = capacitance value in pF at 85 C
 δ_1 = 20 C
 δ_2 = 85 C

TOLERANCE OF THE TEMPERATURE COEFFICIENT OF CLASS 1 CAPACITORS

Various influences during the manufacturing process of the ceramic dielectric materials may cause deviations from the nominal α_c values.

In addition, the relatively higher stray capacitances connected with small capacitance values (below 50pF) modify the α_c value.

The permissible deviation of the actual α_c values from the nominal ones are comprised within the α_c tolerances.

In accordance with EN 130600, we manufacture capacitors with the following α_c values and associated tolerances:

Class 1 A = narrowed α_c tolerance

Class 1 B = standard α_c tolerance

Class 1 F = extended α_c tolerance

General Information

Vishay Draloric

Ceramic Singlelayer Capacitors



TOLERANCE OF THE TEMPERATURE COEFFICIENT OF CLASS 1 CAPACITORS

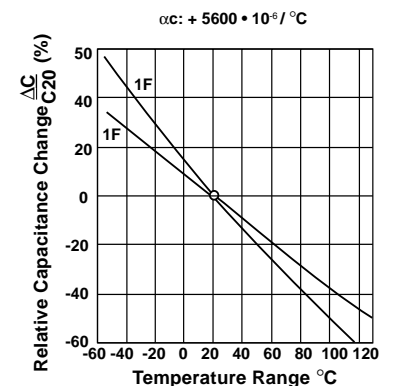
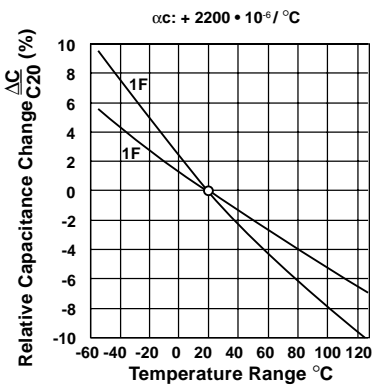
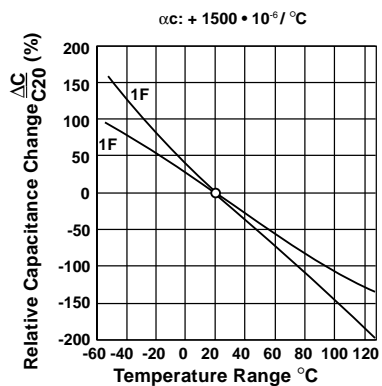
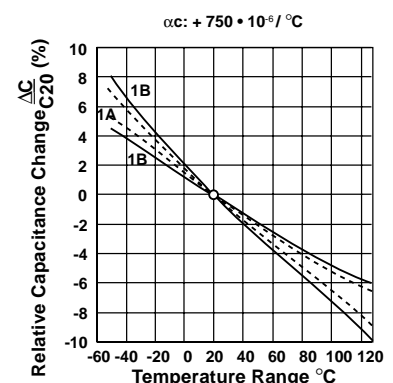
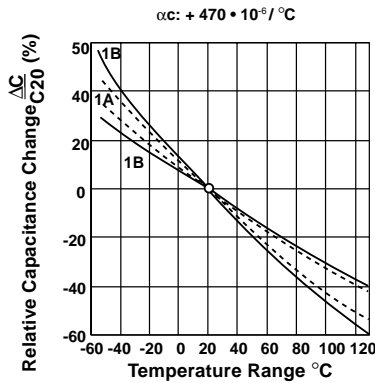
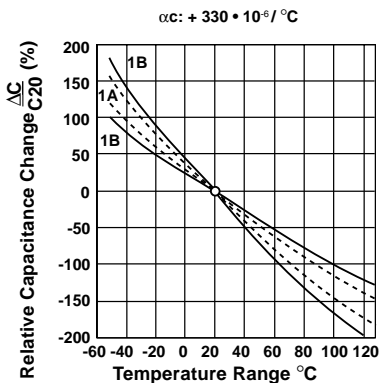
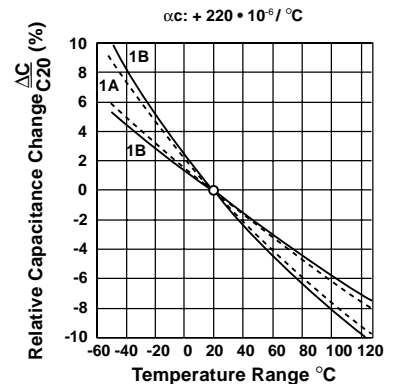
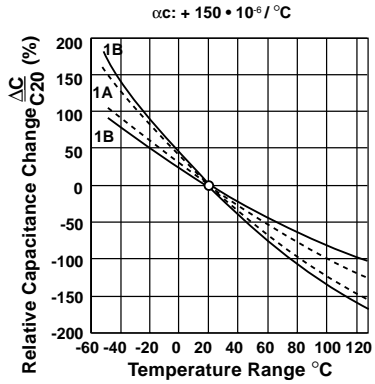
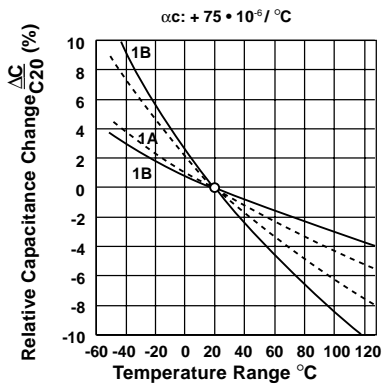
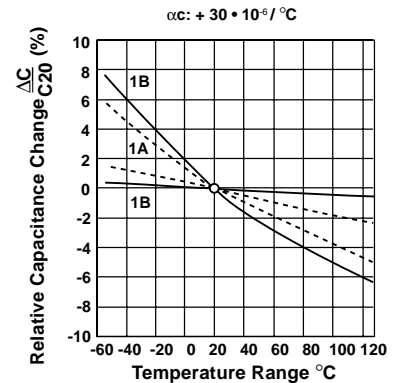
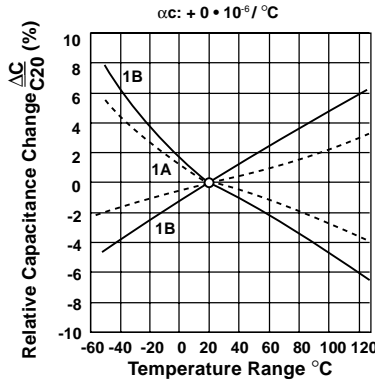
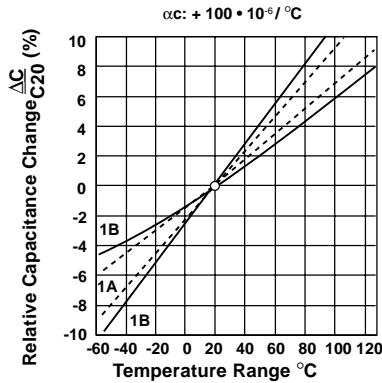
TEMPERATURE COEFFICIENT		α_c TOLERANCE ($10^{-6}/^{\circ}\text{C}$)												
DESIGNATION	NOMINAL VALUE ($10^{-6}/^{\circ}\text{C}$)	1 A		1 B					1 F					
		$C_N(\mu\text{F})$		$C_N(\mu\text{F})$					$C_N(\mu\text{F})$					
		15 to 20	> 20	< 3	3 to < 6.2	6.2 to < 10	10 to < 15	≥ 15	< 3	3 to 6.2	> 6.2			
P 100	+ 100	± 20	± 15	+ 250 - 30	+ 120 - 30	+ 60 - 30	+ 40 - 30	± 30						
NP 0	± 0													
N 033	- 33													
N 075	- 75													
N 150	- 150													
N 220	- 220													
N 330	- 330	± 40	± 30	+ 250 - 60	+ 125 - 60	+ 90 - 60	+ 70 - 60	± 60						
N 470	- 470													
N 750	- 750	± 80	± 60	+ 250 - 120	± 120	± 120	± 120	± 120						
N 1500	- 1500											+ 500 - 250	+ 500 - 250	± 250
N 2200	- 2200											+ 1000 - 500	± 500	± 500
N 5600	- 5600											+ 1500 - 1000	± 1000	± 1000

PERMISSIBLE RELATIVE CAPACITANCE VARIATION REFERRED TO THE VALUE AT 20°C.

TEMPERATURE COEFFICIENT		PERMISSIBLE RELATIVE CAPACITANCE VARIATION (10^{-3})									
NOMINAL VALUE	TOLERANCE	- 55°C		- 40°C		- 25°C		+ 85°C		+ 125°C	
		min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
+100	15 (1A) 30 (1B)	- 8.63 - 9.75	- 5.90 - 4.10	- 6.90 - 7.80	- 4.76 - 3.38	- 5.18 - 5.85	- 3.60 - 2.61	5.53 4.55	7.48 8.45	8.93 7.35	11.9 13.5
± 0	15 (1A) 30 (1B)	- 1.13 - 2.25	2.67 4.05	- 0.904 - 1.80	2.00 3.09	- 0.678 - 1.35	1.40 2.20	- 0.975 - 1.95	0.975 1.95	- 1.58 - 3.15	1.69 3.23
- 033	15 (1A) 30 (1B)	1.35 0.225	5.65 7.05	1.08 0.180	4.34 5.44	0.810 0.135	3.13 3.93	- 3.12 - 4.10	- 1.17 - 0.195	- 5.04 - 6.62	- 1.75 - 0.291
- 075	15 (1A) 30 (1B)	4.50 3.38	9.65 11.5	3.60 2.70	7.47 8.89	2.70 2.03	5.42 6.43	- 5.85 - 6.83	- 3.90 - 2.93	- 9.45 - 11.0	- 5.74 - 4.25
- 150	15 (1A) 30 (1B)	10.1 9.00	16.9 18.2	8.08 7.20	13.1 14.1	6.06 5.40	9.55 10.3	- 10.7 - 11.7	- 8.78 - 7.80	- 17.3 - 18.9	- 13.1 - 11.5
- 220	30 (1A) 60 (1B)	5.4 14.3	23.2 24.5	12.3 11.4	18.1 19.1	9.24 8.58	13.2 14.0	- 15.3 - 16.3	- 13.3 - 12.4	- 24.7 - 26.3	- 20.2 - 18.9
- 330	30 (1A) 60 (1B)	22.5 20.3	33.4 38.3	18.0 16.2	26.2 29.9	13.5 12.2	19.2 21.8	- 23.4 - 25.4	- 19.5 - 17.7	- 37.8 - 41.0	- 29.5 - 26.7
- 470	60 (1A) 120 (1B)	33.0 30.8	48.5 51.2	26.4 24.6	37.9 40.0	19.8 18.5	27.7 29.3	- 32.5 - 34.5	- 28.6 - 26.7	- 52.5 - 55.7	- 43.2 - 40.5
- 750	15 (1A) 30 (1B)	51.8 47.3	76.5 82.4	41.4 37.8	59.9 64.5	31.1 28.4	43.9 47.3	- 52.7 - 56.6	- 44.9 - 41.0	- 85.1 - 91.4	- 67.8 - 65.6
- 1500	250 (1F)	93.8	161	75.0	126	56.3	92.8	- 114	- 81.3	- 184	- 131
- 2200	500 (1F)	128	248	102	195	76.8	143	- 176	- 111	- 284	- 179
- 5600	1000 (1F)	345	607	276	476	207	350	- 429	- 299	- 693	- 483



CAPACITANCE CHANGE VS. TEMPERATURE OF CLASS 1 CAPACITORS



C20: Capacitance at 20 C without DC -voltage
Measuring frequency: 1MHz
Measuring voltage: $\geq 5V_{RMS}$

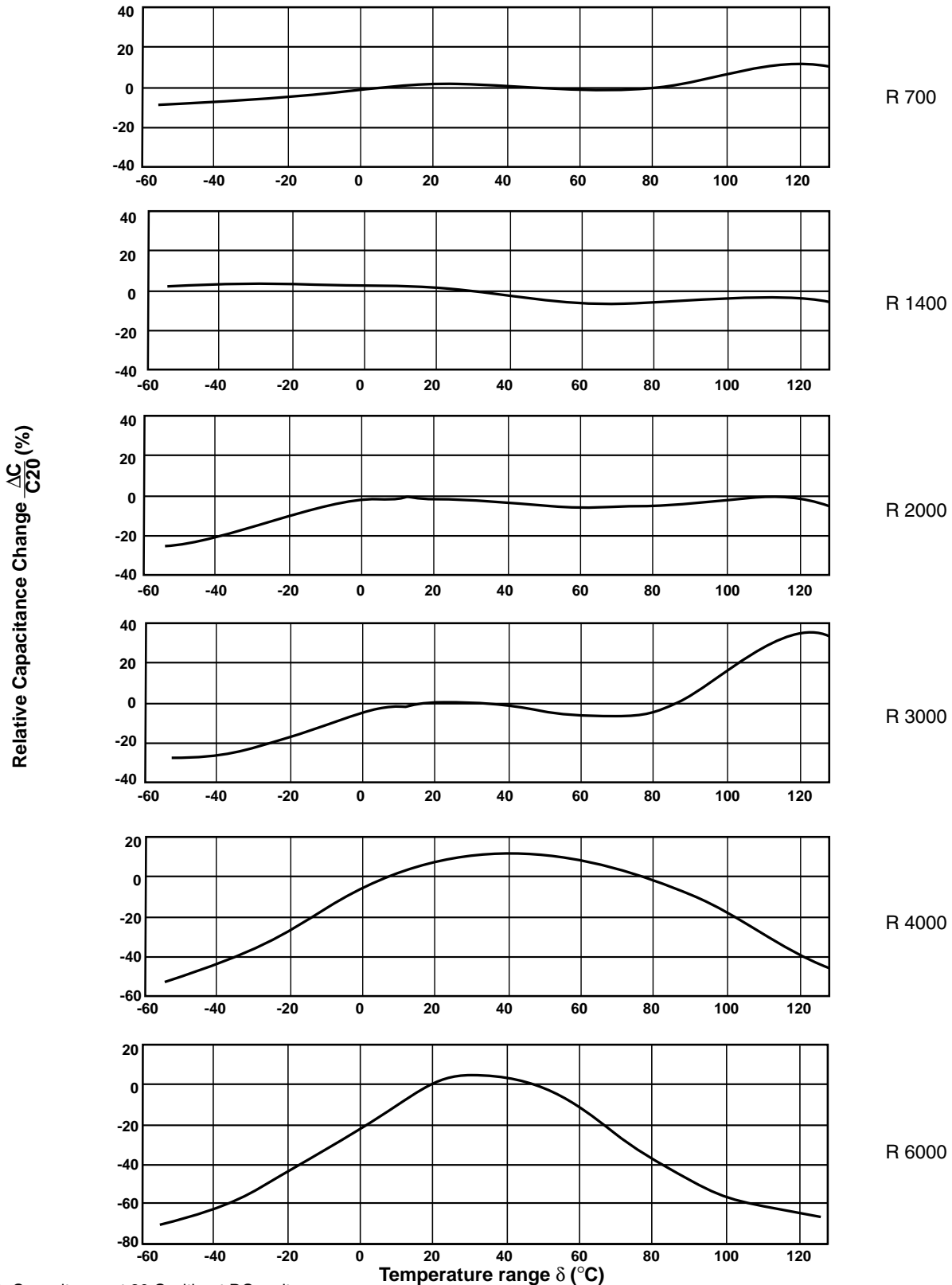
General Information

Vishay Draloric

Ceramic Singlelayer Capacitors



TEMPERATURE DEPENDENCY OF THE CAPACITANCE WITH CLASS 2 CAPACITORS



C20: Capacitance at 20 C without DC -voltage
 Measuring frequency: 1MHz
 Measuring voltage: $\geq 5V_{RMS}$



TABLE OF TEMPERATURE CHARACTERISTIC DESIGNATIONS OF CLASS 2 CAPACITORS.

VISHAY DRALORIC CERAMIC TYPE	TEMPERATURE RANGE (°C)	MAX. CHANGE OF CAPACITANCE VALUE FROM VALUE AT 20 °C		REFERENCE TEMPERATURE CHARACTERISTIC ACCORDING TO IEC 60384-9	REFERENCE TEMPERATURE CHARACTERISTIC ACCORDING TO EIA RS-198
		without DC Voltage	with UR		
R 700, R 1400	- 25 to + 85	± 20%	+ 10 - 15%	2B4	Y5P
	- 55 to + 85	± 20%	+ 10 - 15%	2B4	Y5P
R 2000, R 3000	- 25 to + 85	+ 20 - 30%	+ 20 - 30%	2C4	Y5S
	- 55 to + 85	+ 20 - 30%	+ 20 - 40%	2D2	Y5S
R 4000, R 6000	- 25 to + 85	+ 20 - 55%	+ 20 - 65%	2E4	Y5U
R 4000	- 55 to + 85	+ 20 - 55%	+ 20 - 65%	2E2	X5U

• Marking of the temperature characteristic according IEC 60384-9 resp. EIA RS-198 see General Information.

CAPACITANCE “AGEING” OF CERAMIC CAPACITORS

Following the final heat treatment, all class 2 ceramic capacitors reduce their capacitance value approximation wise according to a logarithmic law due to their special crystalline construction. This change is called “ageing”. If the capacitors are heat treated for example when soldering, the capacity increases again to a higher value and the ageing process begins again. (note: the level of this de-ageing is dependant on the temperature and the duration of the heat, an almost complete de-ageing is achieved at 150 C in one hour; these conditions also form the basis for reference measurements when testing). The capacitance change per time decade (ageing constant) differs for the various types of ceramic but typical values can be taken from the table below.

CERAMIC DIELECTRIC	R 700	R 1400	R 2000	R 3000	R 4000	R 6000
AGEING CONSTANT (k)	- 1%	- 2%	- 2%	- 1%	- 4%	- 4%

$$k = \frac{100 \cdot (C_{t1} - C_{t2})}{C_{t1} \cdot \log_{10} (t1 / t2)}$$

t1, t2 = measuring time point (h)
 C_{t1}, C_{t2} = capacitance values for the times t1, t2
 k = ageing constant (%)

$$C_{t2} = C_{t1} \cdot (1 - \frac{k}{100} \cdot \log_{10} [t1 / t2])$$

REFERENCE MEASUREMENT:

Due to ageing it is necessary to quote an age for reference measurements which can be related to the capacitance with fixed tolerance. According to EN 130700 this time period is 1000 hours.

If the shelf-life of the capacitor is known, the capacitance for t = 1000h can be calculated with the ageing constant.

In order to avoid the influence of the ageing, it is important to de-age the capacitors before stress-testing.

The following procedure is adopted (see also EN 130700) :

- De-ageing at 150 C, 1hour
- Storage for 24 hours at normal climate temperature
- Initial measurement
- Stress
- De-ageing at 150 C, 1hour
- Storage for 24 hours at normal climate temperature
- Final measurement



RATED VOLTAGE (U_R)

The rated voltage U_R is the highest permissible value of the sum of d.c voltage and the peak value of the alternating voltage applied to the capacitor at any temperature within the permissible temperature range. This voltage is indicated in the data sheets for every capacitor type with the upper limit for the r.m.s value of the alternating voltage added.

The max. power loss (P_{Vmax}) and the max. reactive current (I_{max}) should also be taken into consideration.

DIELECTRIC STRENGTH AND TEST CONDITIONS

The test of dielectric strength is carried out as a 100% measurement.

The test may be repeated only once by the user, e.g. to prevent too frequent preloading of the dielectric.

Test Voltage:	Direct Voltage	
Value of Test Voltage	Rated Voltage $\leq 330V$:	Test Voltage = $3 \cdot U_R$
	Rated Voltage $> 330V$:	Test Voltage = $1.5 \cdot U_R + 500V_{DC}$
	Rated Voltage 400V / 500V:	Test Voltage = $1250V_{DC}$
	Rated Voltage 700V:	Test Voltage = $1550V_{DC}$
Charge / Discharge Current:	max. 50mA	
Duration:	$(1 \pm 0.2) s$	
Temperature:	+ 15 C to + 35 C	
Relative Humidity:	$\leq 75\%$	

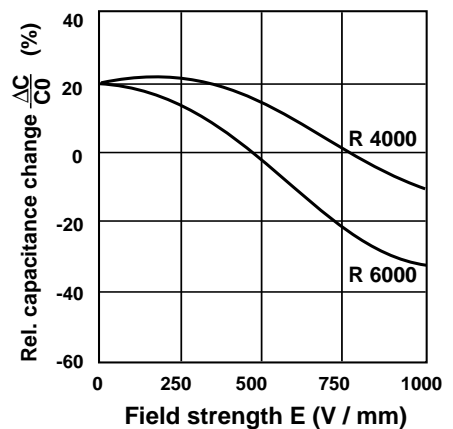
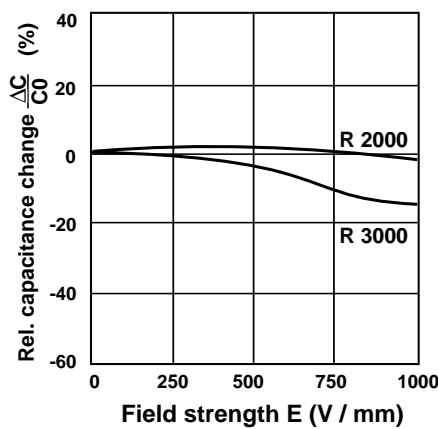
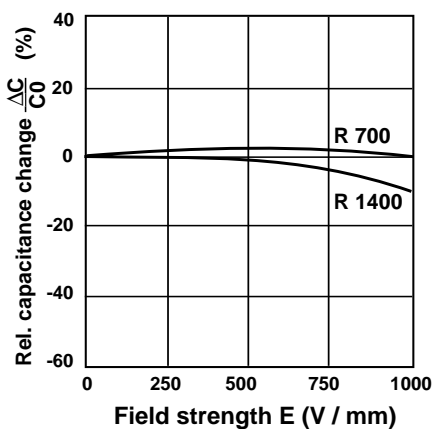
CAPACITANCE INDEPENDANCE OF FREQUENCY

In ceramic capacitors of Class 1 and 2, the capacitance is practically independent of the frequency. If however, a capacitor is operated near its 1st self resonance (series resonance), the self inductance causes a decrease of the impedance between the connecting points, which is equivalent to a capacitance increase.

DC - VOLTAGE DEPENDENCY OF CAPACITANCE (TYPICAL VALUES)

The capacitance of Class 1 capacitors scarcely changes when DC bias voltage is applied.

The curves below show the relative variation of Capacitance vs. Field strength E of Class 2 capacitors (Typical values, voltage referred to thickness of ceramic dielectric).



C_0 : Capacitance without DC voltage
 Measuring Frequency: 1kHz
 Temperature: $(23 \pm 3)^\circ C$
 Measuring Voltage: $\leq 1.5V_{RMS}$

A.C. VOLTAGE LOAD (GENERAL)

The permissible a.c. load of a ceramic capacitor depends on the following characteristics and data:

Permissible field strength in the ceramic material

Dissipation factor of the ceramic material

Permissible RF current

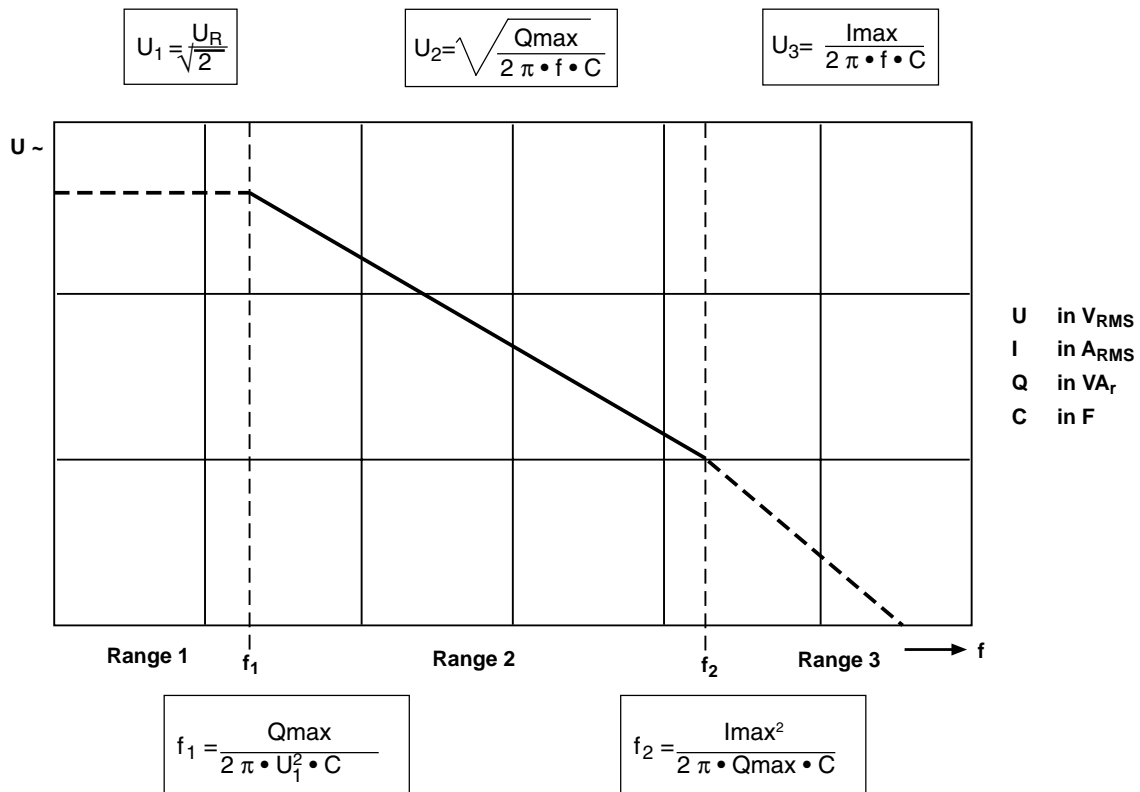
Style

Dimensions of external surface } thermal resistance towards the environment

Frequency and distortion curve of the RF voltage

Ambient temperature

For every capacitor three frequency ranges are to be distinguished for a.c. permissible voltage. The formulae giving the permissible effective voltage and the limits of the ranges are stated in the following diagram (referred to as a sinusoidal a.c. voltage):



Range 1: In the low - frequency range the voltage U_1 is limited by the permissible field strength and is generally $U_R / \sqrt{2}$.
See specification on the relevant data sheet.

Range 2: Above the frequency limit f_1 the voltage U_2 is limited by the permissible reactive power Q_{max} .

Range 3: Above the frequency limit f_2 the voltage U_3 is limited by the permissible reactive power I_{max} .

General Information



Vishay Draloric

Ceramic Singlelayer Capacitors

PERMISSIBLE POWER LOSS (P_{VMAX}) AND REACTIVE CURRENTS (I_{MAX})

TUBULAR CAPACITORS								
SIZE	I_{MAX} (A_{RMS})	P_{VMAX} (mW)	SIZE	I_{MAX} (A_{RMS})	P_{VMAX} (mW)	SIZE	I_{MAX} (A_{RMS})	P_{VMAX} (mW)
0205	0.5	15	0310	0.5	50	0416	0.75	100
0207	0.5	20	0312	0.5	60	0420	0.75	135
0208	0.5	24	0314	0.5	70	0425	0.75	170
0209	0.5	27	0316	0.5	80	0430	0.75	200
0210	0.5	30	0320	0.5	100	0440	0.75	270
0211	0.5	33	0325	0.5	125			
0212	0.5	36	0330	0.5	150			
0213	0.5	39						
0214	0.5	42						
0216	0.5	48						
0220	0.5	60						

• For the values of Ceramic feed-through capacitors & filters see the relevant data sheets.

PERMISSIBLE REACTIVE POWER (P_{BMAX})

$\tan \delta (10^{-3})$	0.5	0.8	1.5	2	2.5	5	10	12	25	50	100
Dissipated Power P_{Vmax} (mW)	Reactive Power P_{Bmax} (VA)										
6	12	7.5	4.0	3.0	2.4	1.2	0.6	0.5	0.24	0.12	0.06
10	20	12.5	6.7	5.0	4.0	2.0	1.0	0.83	0.4	0.2	0.1
13	26	16.3	8.7	6.5	5.2	2.6	1.3	1.1	0.52	0.26	0.13
18	36	22.5	12	9.0	7.2	3.6	1.8	1.5	0.72	0.36	0.18
20	40	25	13.3	10	8.0	4.0	2.0	1.7	0.8	0.4	0.2
24	48	28.8	16	12	9.5	4.8	2.4	2.0	0.95	0.48	0.24
27	54	33.7	18	13.5	10.8	5.4	2.7	2.2	1.1	0.54	0.27
30	60	37.6	20	15	12	6.0	3.0	2.5	1.2	0.6	0.3
36	72	45	24	18	14	7.2	3.6	3.0	1.4	0.72	0.36
42	84	52.5	28	21	17	8.4	4.2	3.5	1.7	0.84	0.42
48	96	60	32	24	19	9.6	4.8	4.0	1.9	0.96	0.48
50	100	62.5	33	25	20	10	5	4.2	2.0	1.0	0.5
60	120	75	40	30	24	12	6.0	5.0	2.4	1.2	0.6
70	140	87.5	47	35	28	14	7.0	5.8	2.8	1.4	0.7
75	150	94	50	37.5	30	15	7.5	6.2	3.0	1.5	0.75
80	160	100	53	40	32	16	8.0	6.7	3.2	1.6	0.8
100	200	125	67	50	40	20	10	8.3	4.0	2.0	1.0
120	240	150	80	60	48	24	12	10	4.8	2.4	1.2
125	250	156	83	63	50	25	12.5	10	5.0	2.5	1.25
135	270	169	90	68	54	27	13.5	11	5.4	2.7	1.35
140	280	175	93	70	56	28	14	12	5.6	2.8	1.4
150	300	188	100	75	60	30	15	13	6.0	3.0	1.5
160	320	200	107	80	64	32	16	13	6.4	3.2	1.6
170	340	213	113	85	68	34	17	14	6.8	3.4	1.7
200	400	250	133	100	80	40	20	17	8.0	4.0	2.0
270	540	337	180	135	108	54	27	22	11	5.4	2.7
300	600	375	200	150	120	60	30	25	12	6.0	3.0
340	680	425	226	170	136	68	34	28	14	6.8	3.4

The above values for dissipated power P_{Vmax} refer to a temperature rise of 30 C and apply to an ambient temperature of 55 C. For other ambient temperature δ_u between 55 C and 85 C the limiting values for P_V and P_B may be computed from the formulae below:

$$P_{V_{\delta_u}} = \frac{85 - \delta_u}{30} \cdot P_{Vmax}$$

$$P_{B_{\delta_u}} = \frac{85 - \delta_u}{30} \cdot P_{Bmax}$$



DISSIPATION FACTOR: LIMITING AND AVERAGE VALUES

CLASS	CERAMIC DIELECTRIC	AVERAGE VALUES $\tan \delta (10^{-3})$	LIMITING $\tan \delta (10^{-3})$	CLASS	CERAMIC DIELECTRIC	AVERAGE VALUES $\tan \delta (10^{-3})$	LIMITING $\tan \delta (10^{-3})$
1	P 100	0.4	≤ 1.0	2	R 700	12	≤ 25
	NP 0	0.4			R 1400	10	
	N 033	0.4			R 2000	11	
	N 075	0.4			R 3000	11	
	N 150	0.4			R 4000	12	
	N 220	0.5			R 6000	15	
	N 330	0.5					
	N 470	0.5					
	N 750	0.5					
	N 1500	0.5					
		N 2200	1.0	≤ 1.5			
	N 5600						

The AVERAGE VALUES of the table for dissipation refer to capacitances above 50pF and are values averaged from systematic sample measurements of several years on all types of capacitors.

The LIMITING VALUES are the values used as requirements in all our tests. They apply to capacitance values above 50pF. If for certain capacitor styles different $\tan \delta$ limits should apply they are stated in the relevant data sheets.

DISSIPATION FACTOR: LIMITING VALUES AT LOW CAPACITANCE

The electrical field in a ceramic capacitor acts not only in the dielectric but also in the coating. With capacitance values below 50pF, the latter portion of the field causes an increase of the dissipation factor. For class 1 capacitors in the range of 5 to 50pF, $\tan \delta$ limits according to the formulae specified in EN 130600 or IEC 60384 apply:

$$\tan \delta = \frac{(15 + 0.7) \cdot 10^{-3}}{C}$$

(C = nominal capacitance in pF)

For feed through capacitors with screw terminals and class 1 dielectric, the following $\tan \delta$ limiting values apply:

$$C > 50\text{pF}: \tan \delta \leq 1.5 \cdot 10^{-3}$$

$$C > 5 \text{ to } 50\text{pF}: \tan \delta \leq \frac{(22.5 + 1.05) \cdot 10^{-3}}{C}$$

DISSIPATION FACTOR: MEASURING CONDITIONS

	CLASS 1 CAPACITORS	CLASS 2 CAPACITORS
Measuring Frequency		
C < 100pF	100kHz*	100kHz*
C ≥ 100pF ... 1000pF	100kHz*	1kHz*
C > 1000pF	1kHz*	1kHz*
Measuring Voltage	$\leq 5.0V_{RMS}$	$\leq 1.2V_{RMS}^{**}$
Temperature	$(23 \pm 3) \text{ C}$	
Relative Humidity	$\leq 75\%$	

* Reference measuring at 1MHz

** or $3V_{RMS} / \text{mm}$, whichever is lowest

General Information

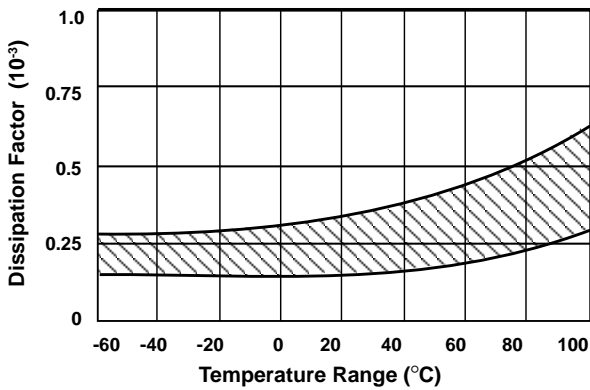


Vishay Draloric

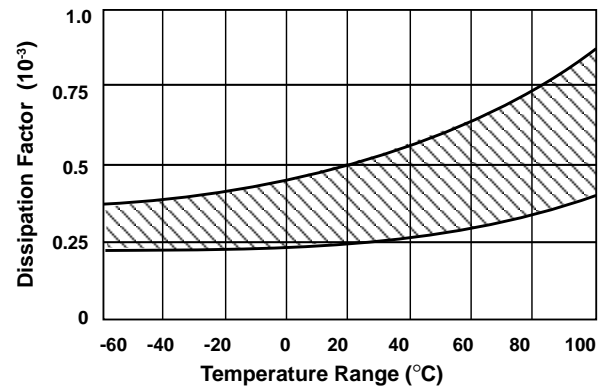
Ceramic Singlelayer Capacitors

TEMPERATURE DEPENDENCY OF DISSIPATION FACTOR (TYPICAL VALUES)

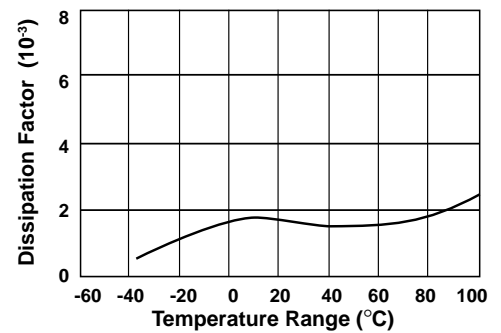
P 100 to N 150



N 220 to N 2200



N 5600



Measuring frequency:

Class 1 : 1MHz

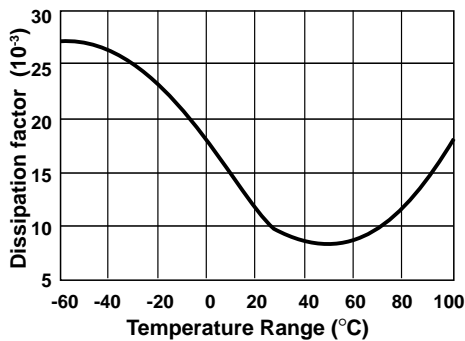
Class 2 : 1kHz

Measuring voltage:

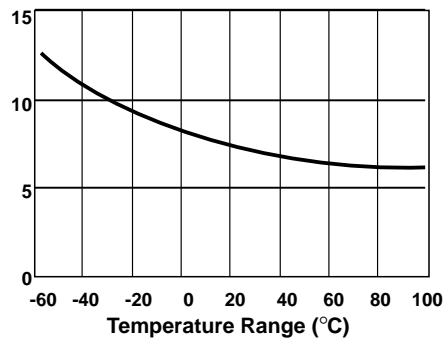
Class 1 : $\leq 5V_{RMS}$

Class 2 : $\leq 1.2V_{RMS}$

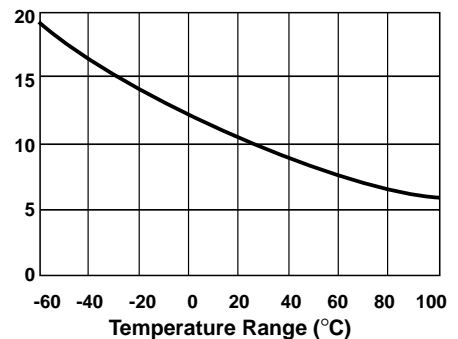
R 700



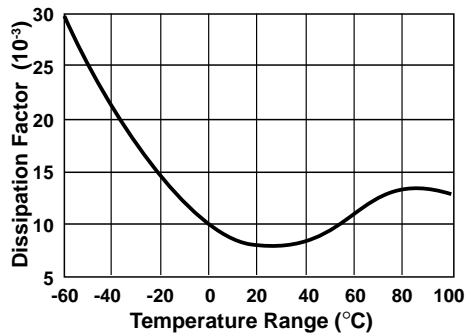
R 1400



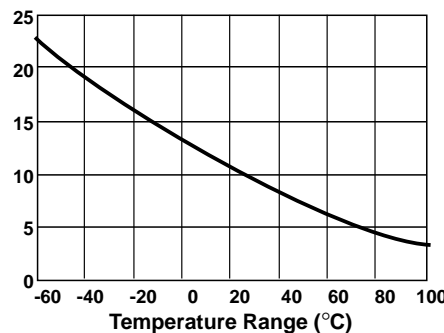
R 2000



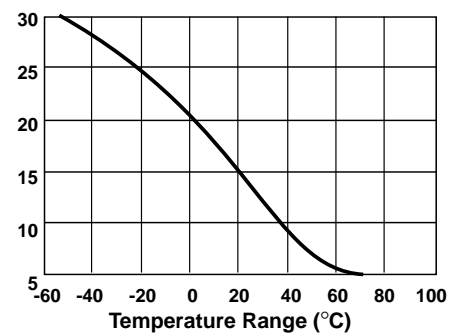
R 3000



R 4000



R 6000

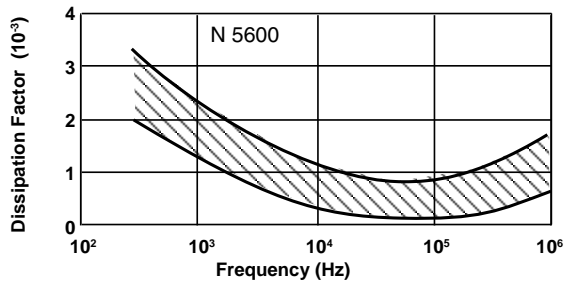
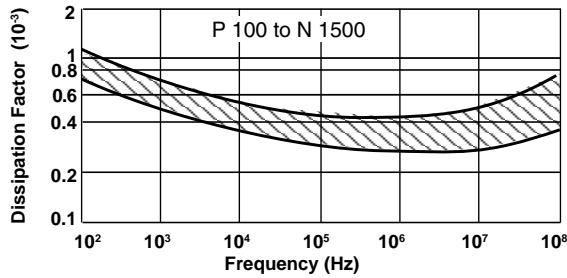


FREQUENCY DEPENDENCY OF DISSIPATION FACTOR (TYPICAL VALUES)

Class 1 Capacitors

Measuring voltage : $\leq 5V_{RMS}$

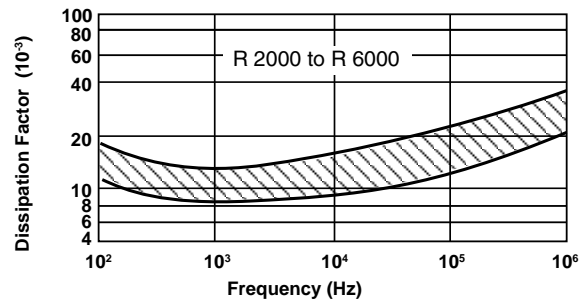
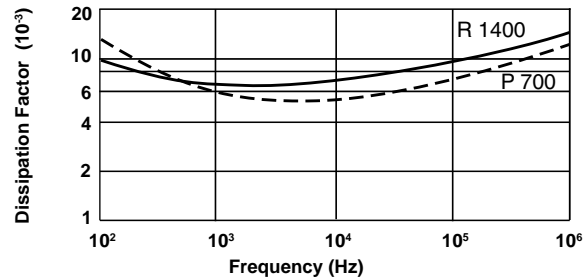
Measuring temperature : $(23 \pm 3)^{\circ}C$



Class 2 Capacitors

Measuring voltage : $\leq 1.2V_{RMS}$

Measuring temperature : $(23 \pm 3)^{\circ}C$



INSULATION RESISTANCE

The insulation resistance is the d.c. resistance of a capacitor, resulting under the conditions specified below, from the bulk resistivity of the dielectric material and the surface resistance. Within the range of the permissible operating temperatures, the bulk resistance of ceramic dielectrics is extremely high so that mainly the surface resistance is measured.

	CLASS 1 CAPACITORS	CLASS 2 CAPACITORS
Limiting Values of the Insulation Resistance	min. $1 \cdot 10^{10} \Omega$	min. $5 \cdot 10^9 \Omega$

INSULATION RESISTANCE : MEASURING CONDITIONS

Measuring Voltage	Rated Voltage $\leq 100V$: U_R
	Rated Voltage $> 100V$: $100V_{DC}$
Duration	$(60 \pm 5)s$
Temperature	$(23 \pm 3) C$
Relative Humidity	$\leq 75\%$

The measurement of insulation resistance is non-destructive.

For tubular capacitor sets (connection in parallel) it should be noted that the resulting value must be divided by the number of tubes connected in parallel.

RESONANT FREQUENCIES FOR SMALL CERAMIC CAPACITORS

At higher frequencies, the inductance of the capacitor causes SELF RESONANCES which may effect the dimensioning of the circuit. In addition, impedance of the capacitors decreases closely below the resonant frequency. The effect of this resonancy equals an increase in capacitance.

Above a resonant frequency the inductive impedance increases. If necessary, the decrease has to be considered when determining the HF load.

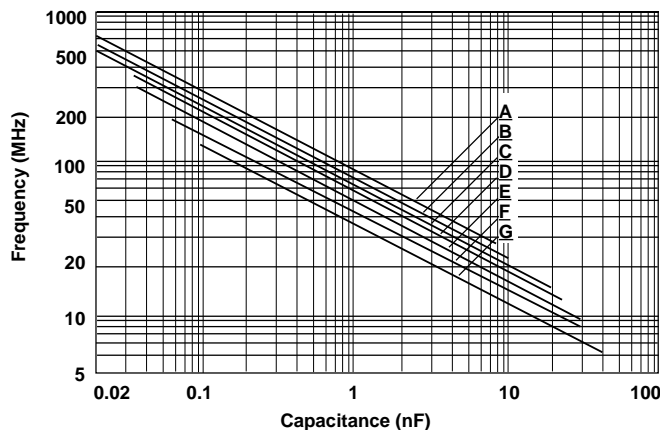
The self-inductance of ceramic capacitors is dependant on their specific dimensons, in which the inductance of the leads is a significant factor.

Due to the influence of the capacitors shape only an inaccurate calculation of the self-resonance is possible.

We have determined the resonant frequencies of our capacitors as a function of capacitance by numerous measurements. The results are shown in the graphs below.

SELF-RESONANT FREQUENCY AS A FUNCTION OF CAPACITANCE

Tubular Capacitors



GRAPH	CAPACITOR SIZE
A	R... 0210, 0310
B	R...0212, 0214, 0312, 0314
C	R... 0216, 0316, 0416
D	R... 0202,00320, 0420
E	R...0325, 0425
F	R... 03030, 04030
G	R... 0440

SHORT-TERM STABILITY (KzK)

During operating a ceramic capacitor the capacitance value may change for short periods of time. These changes are normally of no importance and can only be noticed with very sensitive measuring devices. For higher requirements e.g. in commercial applications, we can supply tubular capacitors, the inconsistency of which has been reduced to a minimum.

There are three grades of capacitors with guaranteed short-term stability:

Short term-stability Grade 4 capacitance variations $\leq 1 \cdot 10^{-4}$

Short term-stability Grade 5 capacitance variations $\leq 1 \cdot 10^{-5}$

Short term-stability Grade 6 capacitance variations $\leq 1 \cdot 10^{-6}$

(of normal capacitance value)

The required short-term stability grade is guaranteed if the permissible operating voltage as stated on the data sheet is not exceeded.

Short term stability measuring frequency: 1MHz (see EN 130600 or IEC 60384).

COMPONENT CLIMATIC CATEGORY

According to IEC 60068-1 the climatic category is described by a three set code.

For details see General Information



SOLDERING

SOLDERING SPECIFICATIONS

Soldering test for capacitors with leads: (according to IEC 60068-2-20, solder bath method).		
	SOLDERABILITY	RESISTANCE TO SOLDERING HEAT
Soldering Temperature	(235 ± 5) C	(260 ± 5) C
Soldering Duration	(2 ± 0.5) sec.	(10 ± 1) sec.
Distance from Component Body	≥ 2mm	≥ 5mm

SOLDERING RECOMMENDATIONS

Mounting of the component should be achieved using SN 60/40 or silver bearing SN62/36/2AG solder, whereby solder wire, cream or preforms are acceptable. Only a mildly active, resin flux should be used.

We recommend the use of a heat sink adjacent to the component body if possible.

As ceramic capacitors are very sensitive to rapid changes in temperature (Thermal shock) a pre-heat and post-heat cycle is strongly recommended.

Both the component and ground plate should be heated up to 120°C (Heat must not be applied directly to the ceramic body and the temperature on the component surface should not be allowed to increase faster than 100°C per minute).

After the pre-heat cycle the mounting plate temperature should be raised to achieve solder flow. The solder flow state should be maintained for a minimum period (recommendation: less than 5s) and the tip temperature should be maintained for a minimum period (recommendation: less than 5s) and the tip temperature should be as low as possible (max. 260°C)

The assembly should be allowed to cool at a rate not exceeding 100°C per minute.

CLEANING

The components should be cleaned immediately following the soldering operation with vapor degreasers.

SOLVENT RESISTANCE

The coating and marking of the capacitors are resistant to the following test method: IEC 60068-2-45 (Method XA).

MOUNTING

We do not recommend modifying the lead terminals, e.g. bending or cropping. This action could break the coating or crack the ceramic insert. If however, the lead must be modified in this way, we recommend to support the lead with a clamping fixture next to the coating.

RELIABILITY

By careful control of the manufacturing process stages, the quality of the product is maintained at the highest possible level. To obtain data on the reliability of our ceramic capacitors, many long-term tests under increased temperature and voltage conditions have been carried out in our laboratories.

Based on the results of these tests, the following can be stated:

- Reference conditions: Ambient temperature: (40 ± 2) C
- Relative humidity: (60 ± 2)%
- Electrical stress: 50% rated voltage (U_R)

Failure criteria: Short circuit (R ≤ 10⁻⁵Ω) or open circuit

- Failure tests: Class 1 capacitors: λ = 2 x 10⁻⁹ h⁻¹
- Class 2 capacitors: λ = 5 x 10⁻⁹ h⁻¹

By derating the voltage load, greatly increased reliability can be predicted.

Temperature, up to the maximum category temperature, is not believed to significantly affect the reliability.

MARKING

Unless otherwise indicated in the data sheet, the following designations will be used

1. NOMINAL CAPACITANCE

The nominal value of capacitance is marked PICO FARAD (pF). The designation is omitted in this case or in NANOFARAD (nF) which is indicated by 'n' following the numbers. On small capacitor sizes an abbreviated marking is used.

Examples are shown in the table below.

EXAMPLES OF ABBREVIATED DESIGNATION	
0.68pF	p 6 8
5pF	5 p 0
22pF	2 2 p
150pF	n 1 5
1nF	1 n 0
15nF	1 5 n

2. CAPACITANCE TOLERANCE

The capacitance tolerance is marked in pF (nominal capacitances less than 10pF) or in %. Besides marking the tolerances in clear it may be marked with a code letter. See tables below.

CODE LETTER	CAPACITANCE TOLERANCES	
	<10 pF: (pF)	≥ 10pF: (%)
B	± 0.1	-
C	± 0.25	-
D	± 0.5	± 0.5
F	± 1	± 1
G	± 2	± 2.0
H	-	± 2.5
J	-	± 5

CODE LETTER	CAPACITANCE TOLERANCES	
	<10 pF: (pF)	≥ 10pF: (%)
K	-	± 10
M	-	± 20
R	-	- 20 + 30
S	-	- 20 + 50
Z	-	- 20 + 80

3. TEMPERATURE CHARACTERISTIC

The temperature coefficient and the temperature characteristic is marked by one or two colour dots. In exceptional cases letters may be used. See tables below

CLASS 1			
CERAMIC	AC (10 ⁻⁶ / °C)	COLOUR DOTS	CODE LETTER
P 100	+ 100	red / violet	A
NP 0	± 0	black	C
N 033	- 33	brown	H
N 075	- 75	red	L
N 150	- 150	orange	P
N 220	- 220	yellow	R
N 330	- 330	green	S
N 470	- 470	blue	T
N 750	- 750	violet	U
N 1500	- 1500	orange / orange	V
N 2200	- 2200	yellow / orange	K
N 3300	- 3300	green / orange	L
N 5600	- 5600	blue / orange	M

CLASS 2		
CERAMIC	CHARACTERISTICS	COLOUR DOTS
R 700	2 B 4	red
R 1400	2 B 4	red / yellow
R 2000	2 C 4	yellow
R 3000	2 C 4	yellow / green
R 4000	2 E 4	blue
R 6000	2 E 4	blue

4. RATED VOLTAGE

The voltage (DC or AC value) is marked fully or using a code letter. The marking of voltage is omitted on 400V types.



TYPE DESIGNATION

1ST LETTER	SHAPE	TUBULAR & STACK
	G	capacitor stack (disc)
	M	tubular capacitor set
	R	tubular capacitor
2ND LETTER	TYPE OF LEADS / TERMINALS	
	D	straight leads
	F	solder lugs
	Z	special type
3RD LETTER	ARRANGEMENT OF LEADS	
	E	parallel, tangential, short
	L	parallel, tangential, long
	M	radial, long
	P	parallel, radial, long
	Q	tangential, long
	R	parallel, radial, short
	W	at an angle
	Z	special type
4TH LETTER	SURFACE	
	K	solderably varnished
	L	completely laquered
	M	partially laquered
	Q	not laquered
	T	completely resin coated and impregnated
	Z	special type

1ST LETTER	SHAPE	FEED-THROUGH CAPACITOR
	D	Feed-through, tubular case
2ND LETTER	TYPE OF FEED-THROUGH CONDUCTOR	
	D	straight lead
	E	bare electrodes
	U	lead with eyelet
	Z	special type
3RD LETTER	TYPE OF OUTER TERMINAL	
	E	bare electrodes
	L	metallic disc, solderable
	M	threaded
	N	metallic sleeve, solderable
	Z	special type
4TH LETTER	SURFACE	
	K	solderable varnished
	L	completely laquered
	Q	not laquered
	Z	special type

ORDERING INFORMATION					
RDLT	0314	400V_{DC}	56pF	± 20%	N 750
TYPE DESIGNATION	SIZE (Nominal diameter and length of the component)	RATED VOLTAGE	CAPACITANCE VALUE	TOLERANCE	CERAMIC DIELECTRIC





Tubular Ceramic Capacitors & Tubular Capacitor Sets

SERIES	DESIGN	U_R	CAPACITANCE RANGE	PAGE
RDPT 02	Tubular Capacitors with Tangential Lead Terminals	125 / 250V _{DC}	3pF to 0.010μF	74
RDLL 02 RDLT 02	Tubular Capacitors with Tangential Lead Terminals	160V _{DC}	2.2pF to 0.012μF	75
RDLL 02 RDLT 02	Tubular Capacitors with Tangential Lead Terminals	400V _{DC}	3.9pF to 0.012μF	76
RDLL 03 RDLT 03	Tubular Capacitors with Tangential Lead Terminals	400V _{DC}	1pF to 0.020μF	77
RDLL 03 RDLT 03	Tubular Capacitors with Narrow ac-Tolerance	400V _{DC}	15pF to 47pF	78
RDQL 03 RDQT 03	Tubular Capacitors with Controlled Short-Term Stability (Kzk)	400V _{DC}	1pF to 470pF	79
RDLL 04 RDLT 04	Tubular Capacitors with Tangential Lead Terminals	700V _{DC}	11pF to 0.015μF	80
MDLL 02 MDLT 02 MDLL 03 MDLT 03 MDLL 04 MDLT 04	Tubular Capacitor Sets	400V _{DC} 400V _{DC} 700V _{DC}		81

Ceramic Singlelayer Tubular Capacitors, 125V_{DC}/ 250V_{DC}

DESIGN:

Tubular capacitor with brown phenol resin coating, impregnated

RATED VOLTAGE U_R:

Ceramic Class 1: 250V_{DC} (175V_{RMS})
 Ceramic Class 2: 125V_{DC} (90V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

Ceramic Class 1: 750V_{DC} 1s
 Ceramic Class 2: 375V_{DC} 1s

DISSIPATION FACTOR tan δ:

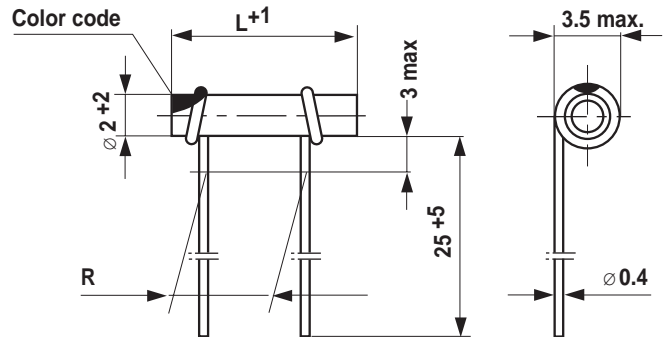
Ceramic Class 1: see General Information
 Ceramic Class 2: ≤ 25 • 10⁻³

INSULATION RESISTANCE R_{IS}:

Ceramic Class 1: ≥ 1 • 10¹⁰ Ω
 Ceramic Class 2: ≥ 5 • 10⁹ Ω

CATEGORY TEMPERATURE RANGE ϑ_A:

Ceramic Class 1: (- 55 to + 125)°C
 Ceramic Class 2: (- 25 to + 85)°C



• Dimensions in mm

CLIMATIC CATEGORY ACC. TO EN 60068-1:

55 / 085 / 56

MARKING:

Capacitance value,
 Tolerance letter (RDPT 0211 & 0213 only).
 Ceramic dielectric color code

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF) AT NOMINAL TUBE LENGTH L (mm)				
		5 (0205)	7 (0207)	9 (0209)	11 (0211)	13 (0213)
1B	P 100	3.0 to 7.5	to 11	to 18	to 27	to 36
	NP 0	6.8 to 12	to 20	to 30	to 47	to 62
	N 150	6.8 to 18	to 30	to 47	to 68	to 82
	N 750	18 to 51	to 75	to 110	to 160	to 220
2	R 700	100 to 180	to 300	to 470	to 620	to 750
	R 2000	470 to 820	to 1200	to 1800	to 2400	to 3000
	R 4000	820 to 1500	to 3900	to 5600	to 7500	to 10000
Distance between leads R (approx. mm)		3.3	4.5	6.5	8.3	10.6

CERAMIC DIELECTRIC	NOMINAL VALUES	CAPACITANCE TOLERANCES			
P 100 to N 750	< 10pF	± 0.25pF	± 0.5pF	± 1pF	± 2pF
	≥ 10pF	± 2%	± 5%	± 10%	± 20%
R 700 to R 2000		± 20%	- 20 + 50%		
R 4000			- 20 + 50%	- 20 + 80%	

ORDERING INFORMATION				
RDPT 0205	250V-	7.5pF	± 10%	P 100

Ceramic Singlelayer Tubular Capacitors 160V_{DC}

DESIGN:

Tubular capacitor completely lacquered (RDLL)
 Tubular capacitor with brown phenol resin coating, impregnated (RDLT)

RATED VOLTAGE U_R:

160V_{DC} (110V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

480V_{DC} 1s

DISSIPATION FACTOR tan δ:

Ceramic Class 1: see General Information
 Ceramic Class 2: $\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE R_{IS}:

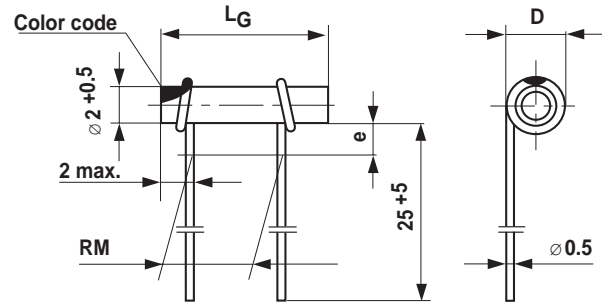
Ceramic Class 1: $\geq 1 \cdot 10^{10} \Omega$
 Ceramic Class 2: $\geq 5 \cdot 10^9 \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

Ceramic Class 1: (- 55 to + 125)°C
 Ceramic Class 2: (- 25 to + 85)°C

CLIMATIC CATEGORY ACC. TO EN 60068-1:

RDLL 40 / 085 / 21
 RDLT 55 / 085 / 56



• Dimensions in mm

	RDLL	RDLT
Coating extension e	2 max.	3 max.
Overall length L _G	L ⁺¹ max.	L ⁺² max.
Overall diameter D	3.5 max.	4.5 max.

MARKING:

Capacitance value,
 Tolerance letter (RDL. 0210 to 0216 only)
 Rated Voltage (RDL. 0216 only)
 Ceramic dielectric colour code

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF) AT NOMINAL TUBE LENGTH L (mm)				
		8 (0208)	10 (0210)	12 (0212)	14 (0214)	16 (0216)
1B	P 100	2.2 to 11	to 18	to 24	to 30	to 36
	NP 0	9.1 to 28	to 39	to 51	to 62	to 75
	N 150	10 to 39	to 56	to 75	to 100	to 120
	N 470	13 to 56	to 82	to 100	to 120	to 150
	N 750	24 to 82	to 120	to 150	to 180	to 220
2	R 700	180 to 560	to 680	to 910	to 1200	to 1500
	R 2000	620 to 1200	to 2000	to 2700	to 3600	to 4300
	R 4000	1000 to 2700	to 3600	to 5100	to 6800	to 8200
	R 6000	2700 to 4700	to 6800	to 8200	to 10000	to 12000
Lead spacing RM (mm)		5 ± 0.7	5 ± 0.7	7.5 ± 0.7	7.5 ± 0.7	7.5 ± 0.7

CERAMIC DIELECTRIC	NOMINAL VALUE	CAPACITANCE TOLERANCE			
P 100 to N 750	< 10pF	± 0.25pF	± 0.5pF	± 1pF	± 2pF
	≥ 10pF	± 2.5%	± 5%	± 10%	± 20%
R 700 to R 2000		± 10%	± 20%	- 20 + 50%	
R 4000 to R 6000			± 20%	- 20 + 50%	-20 + 80%

ORDERING INFORMATION

RDLL 0216	160V _{DC}	12000pF	± 20%	R 6000
-----------	--------------------	---------	-------	--------

Vishay Draloric

Ceramic Singlelayer Tubular Capacitors 400V_{DC}

DESIGN:

Tubular capacitor completely lacquered (RDLL)
 Tubular capacitor with brown phenol resin coating, impregnated (RDLT)

RATED VOLTAGE U_R:

400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

1250V_{DC} 1s

DISSIPATION FACTOR tan δ:

Ceramic Class 1: see General Information
 Ceramic Class 2: $\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE R_{IS}:

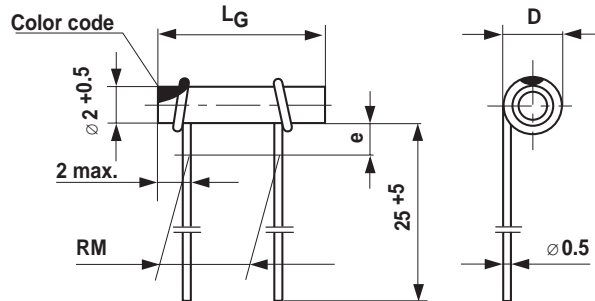
Ceramic Class 1: $\geq 1 \cdot 10^{10} \Omega$
 Ceramic Class 2: $\geq 5 \cdot 10^9 \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

Ceramic Class 1: (- 55 to + 125)°C
 Ceramic Class 2: (- 25 to + 85)°C

CLIMATIC CATEGORY ACC. TO EN 60068-1:

RDLL 40 / 085 / 21
 RDLT 55 / 085 / 56



• Dimensions in mm

	RDLL	RDLT
Coating extension e	2 max.	3 max.
Overall length L _G	L ⁺¹ max.	L ⁺² max.
Overall diameter D	3.5 max.	4.5 max.

MARKING:

Capacitance value, Tolerance letter,
 Rated Voltage (RDL. 0216 & 0220 only)
 Ceramic dielectric color code

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF) AT NOMINAL TUBE LENGTH L (mm)				
		10 (0210)	12 (0212)	14 (0214)	16 (0216)	20 (0220)
1B	P 100	3.9 to 12	to 18	to 24	to 30	to 43
	NP 0	9.1 to 20	to 30	to 43	to 56	to 82
	N 033	9.1 to 22	to 39	to 51	to 62	to 91
	N 075	10 to 27	to 43	to 56	to 68	to 91
	N 150	10 to 30	to 47	to 62	to 82	to 110
	N 220	10 to 33	to 51	to 75	to 91	to 130
	N 330	12 to 39	to 56	to 82	to 100	to 140
	N 470	16 to 47	to 68	to 91	to 120	to 160
2	N 750	27 to 75	to 120	to 160	to 200	to 270
	R 700	180 to 300	to 510	to 680	to 910	to 1200
	R 1400	470 to 820	to 1200	to 1600	to 2000	to 3000
	R 2000	620 to 910	to 1500	to 2100	to 2700	to 3900
	R 4000	1000 to 1800	to 2700	to 4300	to 5600	to 7500
	R 6000	1800 to 3300	to 4700	to 6800	to 8200	to 12000
Lead spacing RM (mm)		5 ± 0.7	5 ± 0.7	7.5 ± 0.7	10 ± 0.7	15 ± 0.7

CERAMIC DIELECTRIC	NOMINAL VALUE	CAPACITANCE TOLERANCE			
P100 to N 750	< 10pF	± 0.25pF	± 0.5pF	± 1pF	± 2pF
	≥ 10 to 24pF	± 2%	± 5%	± 10%	± 20%
	> 24pF	± 1%	± 2%	± 5%	± 10% ± 20%
R 700 to R 2000		± 10%	± 20%	- 20 + 50%	
R 4000 to R 6000			± 20%	- 20 + 50%	- 20 + 80%

ORDERING INFORMATION

RDLL 0220 400V_{DC} 270pF ± 20% N 750



Ceramic Singlelayer Tubular Capacitors 400V_{DC}

DESIGN:

Tubular capacitor completely lacquered (RDLL)
 Tubular capacitor with brown phenol resin coating, impregnated (RDLT)

RATED VOLTAGE U_R:

400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

1250V_{DC}, 1s

DISSIPATION FACTOR tan δ:

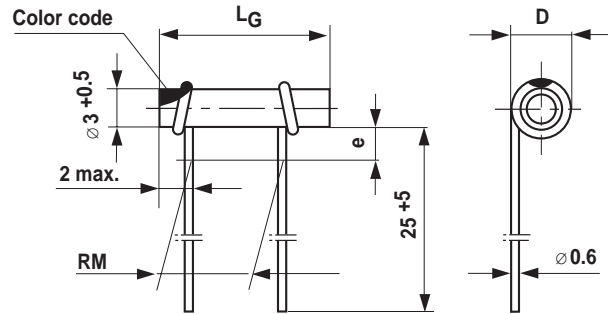
Ceramic Class 1: see General Information
 Ceramic Class 2: $\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE R_{IS}:

Ceramic Class 1: $\geq 1 \cdot 10^{10} \Omega$
 Ceramic Class 2: $\geq 5 \cdot 10^9 \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

Ceramic Class 1: (- 55 to +125)°C
 Ceramic Class 2: (- 25 to + 85)°C



• Dimensions in mm

	RDLL	RDLT
Coating extension e	2 max.	3 max.
Overall length L _G	L+1 max.	L+2 max.
Overall diameter D	5.0 max.	6.0 max.

CLIMATIC CATEGORY ACC. TO EN 60068-1:

RDLL 40 / 085 / 21
 RDLT 55 / 085 / 56

MARKING:

Capacitance value, Tolerance letter,
 Ceramic dielectric color code

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF) AT NOMINAL TUBE LENGTH L (mm)							
		10 (0310)	10 (0310)	12 (0312)	14 (0314)	16 (0316)	20 (0320)	25 (0325)	30 (0330)
1 B	P 100	1.0 to 1.6	to 8.2	to 15	to 20	to 27	to 39	to 56	to 75
	NP 0	2.0 to 8.1	to 22	to 39	to 56	to 75	to 100	to 140	to 180
	N 033	2.0 to 8.4	to 22	to 39	to 56	to 75	to 110	to 150	to 180
	N 075	2.0 to 8.8	to 27	to 43	to 56	to 75	to 110	to 150	to 200
	N 150	2.0 to 9.3	to 27	to 47	to 62	to 82	to 120	to 160	to 220
	N 220	2.0 to 9.9	to 27	to 51	to 75	to 91	to 130	to 180	to 240
	N 330	2.0 to 10.9	to 27	to 56	to 82	to 100	to 150	to 200	to 270
	N 470	3.0 to 12	to 39	to 68	to 91	to 120	to 160	to 220	to 300
1 F	N 750	4.7 to 21	to 51	to 100	to 130	to 160	to 240	to 330	to 470
	N 1500	10 to 39	to 62	to 130	to 180	to 220	to 330	to 430	to 620
2	R 700		200 to 270	to 600	to 820	to 1000	to 1500	to 2000	to 2400
	R 1400		430 to 910	to 1500	to 2000	to 2400	to 3300	to 4700	to 5600
	R 2000		680 to 1000	to 1800	to 2400	to 3300	to 4700	to 6200	to 8200
	R 4000		1000 to 2200	to 3300	to 4300	to 5600	to 8200	to 10000	to 15000
	R 6000		2200 to 3300	to 4700	to 6800	to 8200	to 12000	to 15000	to 20000
Lead spacing RM (mm)		5 ⁺²	5 ± 0.7	7.5 ± 0.7	7.5 ± 0.7	10 ± 0.7	15 ± 0.7	17.5 ± 0.7	20 ± 0.7

CERAMIC DIELECTRIC	NOMINAL VALUE	CAPACITANCE TOLERANCE				
P 100 to N 750	< 10pF		± 0.2pF	± 0.5pF	± 1pF	± 2pF
	≥ 10 to 24pF		± 2%	± 5%	± 10%	± 20%
	> 24pF	± 1%	± 2%	± 5%	± 10%	± 20%
R 700 to R 2000		± 10%	± 20%	- 20 + 50%		
R 4000			± 20%	- 20 + 50%	- 20 + 80 %	
R 6000				- 20 + 50%	- 20 + 80 %	

ORDERING INFORMATION				
RDLL 0314	400V _{DC}	56pF	± 20%	N 750

Vishay Draloric

Ceramic Singlelayer Tubular Capacitors 400V_{DC} with Narrowed α c-tolerance (Class 1A)

DESIGN:

Tubular capacitor completely lacquered (RDLL)
 Tubular capacitor with brown phenol resin coating, impregnated (RDLT)

RATED VOLTAGE U_R:

400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

1250V_{DC}, 1s

DISSIPATION FACTOR tan δ :

See General Information

INSULATION RESISTANCE R_{IS}:

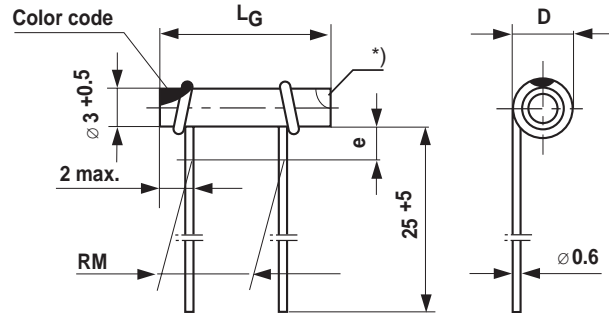
$\geq 1 \cdot 10^{10} \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 55 to + 125)°C

CLIMATIC CATEGORY ACC. TO EN 60068-1:

RDLL 40 / 085 / 21
 RDLT 55 / 085 / 56



• Dimensions in mm

*additional white color dot at the outer electrode terminals indicates narrowed α c-tolerance

	RDLL	RDLT
Coating extension e	2 max.	3 max.
Overall length L _G	L ⁺¹ max.	L ⁺² max.
Overall diameter D	5.0 max.	7.0 max.

MARKING:

Capacitance value, Tolerance letter, Ceramic dielectric color code

CERAMIC DIELECTRIC	CLASS 1A- α c-TOLERANCE (10 ⁻⁶ /°C)		CAPACITANCE VALUES (pF) AT NOMINAL TUBE LENGTH L (mm)						
	15 to 20pF	>20pF	10 (0310)	12 (0312)	14 (0314)	16 (0316)	20 (0320)	25 (0325)	30 (0330)
P 100	± 20	±15	---	15	to 20	to 27	to 39	to 56	to 75
NP 0	± 20	±15	15 to 22	to 39	to 56	to 75	to 100	to 140	to 180
N 033	± 20	±15	15 to 22	to 39	to 56	to 75	to 110	to 150	to 180
N 075	± 20	±15	15 to 27	to 43	to 56	to 75	to 110	to 150	to 200
N 150	± 20	±15	15 to 27	to 47	to 62	to 82	to 120	to 160	to 220
N 220	± 20	±15	15 to 27	to 51	to 75	to 91	to 130	to 180	to 240
N 330	± 35	± 25	15 to 27	to 56	to 82	to 100	to 150	to 200	to 270
N 470	± 50	± 35	15 to 39	to 68	to 91	to 120	to 160	to 220	to 300
N 750	± 80	± 60	15 to 51	to 100	to 130	to 160	to 240	to 330	to 470
Lead spacing RM (mm)			5 ± 0.7	7.5 ± 0.7	7.5 ± 0.7	10 ± 0.7	15 ± 0.7	17.5 ± 0.7	20 ± 0.7

CERAMIC DIELECTRIC	NOMINAL VALUE	CAPACITANCE TOLERANCE				
		P 100 to N 750	15 to 24pF	± 2%	± 5%	± 10%
	> 24pF	± 1%	± 2%	± 5%	± 10%	± 20%

ORDERING INFORMATION

RDLL 0330	400V _{DC}	200pF	± 20%	N 150 / 1A
-----------	--------------------	-------	-------	------------



Ceramic Singlelayer Tubular Capacitors 400V_{DC} with Controlled Short-term Stability (Kzk)

DESIGN:

Tubular capacitor completely lacquered (RDQL)
Tubular capacitor with brown phenol resin coating, impregnated (RDQT)

RATED VOLTAGE U_R:

400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

1500V_{DC} 1s

RF-WORKING VOLTAGE:

25V_{RMS} or 50V_{RMS}

DISSIPATION FACTOR tan δ:

See General Information

INSULATION RESISTANCE R_{IS}:

≥ 1 • 10¹⁰ Ω

CATEGORY TEMPERATURE RANGE ϑ_A:

(- 55 to + 125) C

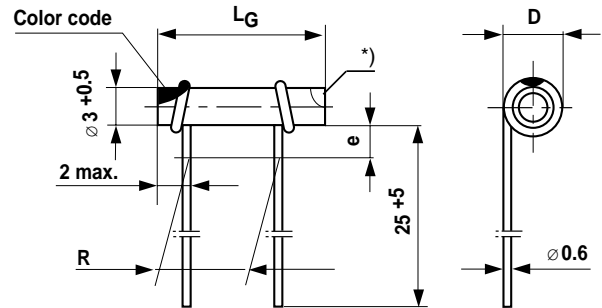
CLIMATIC CATEGORY ACC. TO EN 60068-1:

RDQL 40 / 085 / 21

RDQT 55 / 085 / 56

Kzk-GRADE:

see General Information



• Dimensions in mm

*additional white color dot at the outer electrode terminals indicates narrowed αc-tolerance

	RDQL	RDQT
Coating extension e	2 max.	3 max.
Overall length L _G	L ⁺¹ max.	L ⁺² max.
Overall diameter D	3.5 max.	4.5 max.

MARKING:

Capacitance value, Tolerance letter,
Ceramic dielectric color code, Kzk-grade,
Symbol for short-term stability (RDQ. 0314 to 0330 only)

CERAMIC DIELECTRIC	CLASS 1A-αc-TOLERANCE* (10 ⁻⁶ /°C)		CAPACITANCE VALUES (pF) AT NOMINAL TUBE LENGTH L (mm)						
	15 to 20pF	> 20pF	10 (0310)	12 (0312)	14 (0314)	16 (0316)	20 (0320)	25 (0325)	30 (0330)
P 100	± 20	±15	1.0 to 8.2**	to 15	to 20	to 27	to 39	to 56	to 75
NP 0	± 20	±15	2.0 to 22**	to 39	to 56	to 75	to 100	to 140	to 180
N 033	± 20	±15	2.0 to 22**	to 39	to 56	to 75	to 110	to 150	to 180
N 075	± 20	±15	2.0 to 27**	to 43	to 56	to 75	to 110	to 150	to 200
N 150	± 20	±15	2.0 to 27**	to 47	to 62	to 82	to 120	to 160	to 220
N 220	± 20	±15	2.0 to 27**	to 51	to 75	to 91	to 130	to 180	to 240
N 330	± 35	± 25	2.0 to 27**	to 56	to 82	to 100	to 150	to 200	to 270
N 470	± 50	± 35	3.0 to 39**	to 68	to 91	to 120	to 160	to 220	to 300
N 750	± 80	± 60	4.7 to 51**	to 100	to 130	to 160	to 240	to 330	to 470
Distance between leads R (approx. mm)			7.5	9.5	11.5	13.5	17.5	22.5	27.5

*This series is available in both the Class 1A and Class 1B (standard)

**Class 1A only available ≥ 15pF

CERAMIC DIELECTRIC	NOMINAL VALUE	CAPACITANCE TOLERANCE						
		P 100 to N 750	< 10pF	± 0.25pF	± 0.5pF	± 1pF	± 2pF	
			≥ 10 to 24pF	± 2%	± 5%	± 10%	± 20%	
	> 24pF	± 1%	± 2%	± 5%	± 10%	± 20%		

ORDERING INFORMATION

RDQL 0314	Kzk 4	25V _{RMS}	82pF	± 5%	N 470 / 1A
-----------	-------	--------------------	------	------	------------

RDLL 04.., RDLT 04..



Vishay Draloric

Ceramic Singlelayer Tubular Capacitors 700V_{DC}

DESIGN:

Tubular capacitor completely lacquered (RDLL)
Tubular capacitor with brown phenol resin coating, impregnated (RDLT)

RATED VOLTAGE U_R:

700V_{DC} (500V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

1550V_{DC} 1s

DISSIPATION FACTOR tan δ:

Ceramic Class 1: see General Information
Ceramic Class 2: $\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE R_{IS}:

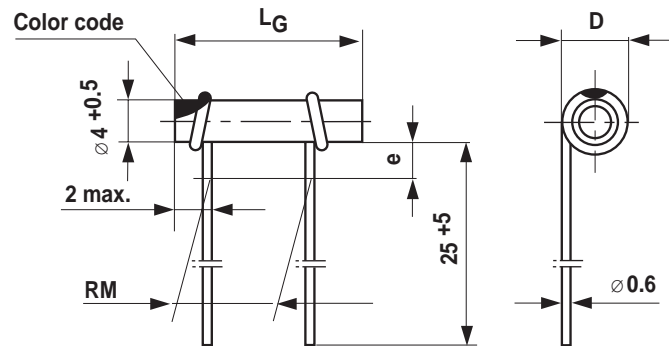
Ceramic Class 1: $\geq 1 \cdot 10^{10} \Omega$
Ceramic Class 2: $\geq 5 \cdot 10^9 \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

Ceramic Class 1: (- 55 to + 125)°C
Ceramic Class 2: (- 25 to + 85)°C

CLIMATIC CATEGORY ACC. TO EN 60068-1:

RDLL 40 / 085 / 21
RDLT 55 / 085 / 56



• Dimensions in mm

	RDLL	RDLT
Coating extension e	2 max.	3 max.
Overall length L _G	L ⁺¹ max.	L ⁺² max.
Overall diameter D	6.0 max.	8.0 max.

MARKING:

Capacitance value, Tolerance letter,
Rated Voltage
Ceramic dielectric color code

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF) AT NOMINAL TUBE LENGTH L (mm)				
		16 (0416)	20 (0420)	25 (0425)	30 (0430)	40 (0440)
1 B	P 100	11 to 24	to 36	to 51	to 68	to 100
	NP 0	12 to 47	to 88	to 100	to 150	to 180
	N 150	20 to 75	to 110	to 150	to 200	to 270
	N 750	51 to 150	to 240	to 330	to 430	to 620
2	R 700	430 to 750	to 1200	to 1600	to 2000	---
	R 2000	1500 to 3000	to 4300	to 6200	to 7500	---
	R 4000	2200 to 4700	to 8200	to 10000	to 15000	---
Lead spacing RM (mm)		10 ± 0.7	15 ± 0.7	17.5 ± 0.7	20 ± 0.7	30 ± 0.7

CERAMIC DIELECTRIC	NOMINAL VALUE	CAPACITANCE TOLERANCE				
P 100 to N 750	< 10pF		± 2.5%	± 5%	± 10%	± 20%
	≥ 10 to 24pF		± 2.5%	± 5%	± 10%	± 20%
	> 24pF	± 1%	± 2.5%	± 5%	± 10%	± 20%
R 700 to R 2000		± 10%	± 20%	- 20 + 50%		
R 4000			± 20%	- 20 + 50%	- 20 + 80%	

ORDERING INFORMATION

RDLL 0440	700V _{DC}	560pF	± 20%	N 750
-----------	--------------------	-------	-------	-------

Ceramic Singlelayer Tubular Capacitor Sets

DESIGN:

Tubular capacitor set completely lacquered (MDLL)
 Tubular capacitor set with brown phenol resin coating, impregnated (MDLT)

RATED VOLTAGE U_R :

MDL. 02. / MDL. 03. : 400V_{DC} (280V_{RMS})
 MDL. 04. : 700V_{DC} (500V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

MDL. 02. / MDL. 03. : 1250V_{DC} 1s
 MDL. 04. : 1550V_{DC} 1s

DISSIPATION FACTOR $\tan \delta$:

See General Information

INSULATION RESISTANCE R_{IS} :

$\geq 1 \cdot 10^{10} \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

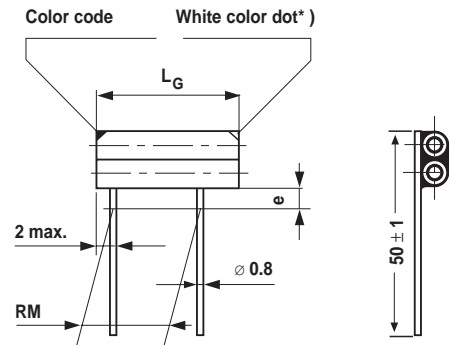
(- 55 to + 125)°C

CLIMATIC CATEGORY ACC. TO EN 60068-1:

MDLL 40 / 085 / 21
 MDLT 55 / 085 / 56

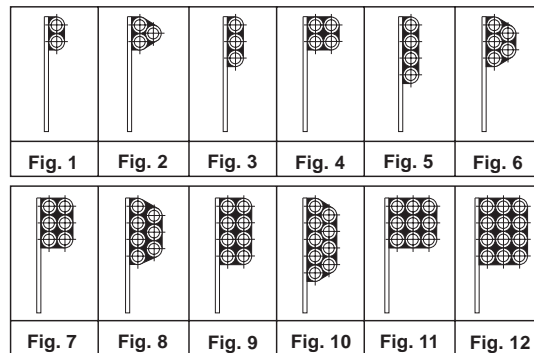
MARKING:

Capacitance value, Tolerance letter,
 Rated Voltage (MDL 04. only)
 Ceramic dielectric color code



• Dimensions in mm

*additional white color dot at the outer electrode terminals indicates narrow α -tolerance



CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF) AT NOMINAL TUBE DIAMETER AND LENGTH L (mm)														
	\varnothing 2mm	10	12	14	16	20									
	\varnothing 3mm	10	12	14	16	20	25	30							
\varnothing 4mm					16	20	25	30	40						
P 100	Values of capacitance result from the individual tubes on the previous pages Capacitor sets are available with the following α -tolerances <table style="float: right; margin-left: 20px;"> <tr> <td>MDL. 02..</td> <td>- Class 1B</td> </tr> <tr> <td>MDL. 03..</td> <td>- Class 1B and Class 1A</td> </tr> <tr> <td>MDL. 04..</td> <td>- Class 1B</td> </tr> </table>									MDL. 02..	- Class 1B	MDL. 03..	- Class 1B and Class 1A	MDL. 04..	- Class 1B
MDL. 02..										- Class 1B					
MDL. 03..										- Class 1B and Class 1A					
MDL. 04..										- Class 1B					
NP 0															
N 033															
N 075															
N 150															
N 220															
N 330															
N 470															
N 750															
Lead spacing RM (mm)	5 ± 0.7	7.5 ± 0.7	7.5 ± 0.7	10 ± 0.7	15 ± 0.7	17.5 ± 0.7	20 ± 0.7	30 ± 0.7							

Capacitance Tolerances: $\pm 1\%$, $\pm 2\%$, $\pm 5\%$, $\pm 10\%$, $\pm 20\%$

ORDERING INFORMATION					
MDLT 0330	400V _{DC}	FIG. 4	1600pF	$\pm 20\%$	N 750 / 1A





Ceramic Feed-Through and Filter Capacitors

SERIES	DESIGN	U_R	CAPACITANCE RANGE	PAGE
DDLK 03..	Feed-Through Capacitors Solder Mount Type	400V _{DC}	1.5pF to 6800pF	85
DDML 0312 DZML 0312 DUML 0312 DVML-A 0416 DVML-B 0416 DVZL 0425	Feed-Through Capacitors Threaded Mount Type	400V _{DC}	1.5pF to 0.010μF	86
DDMZ 0315	Feed-Through Capacitors Bushing Mount Type, Resin Sealed	400V _{DC}	47pF to 4700pF	89
DDML 0825	Feed-Through Capacitors Threaded Mount Type	2000V _{DC}	1000pF to 3300pF	90
DDNL 0409	Filter Capacitors Solder Mount Type	400V _{DC}	1600pF	91
DDML 0310 DDMZ 0312	Filter Capacitors Bushing Mount type Resin Sealed	200V _{DC}	3000pF to 5000pF	92
DDML 0409 DDML 0416 DDML 0420	Filter Capacitors Threaded Mount Type	400V _{DC}	1600pF to 7000pF	94

Ceramic Singlelayer Feed-Through and Filter Capacitors

GENERAL

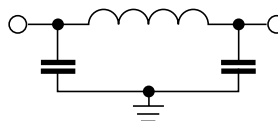
The Feed-through capacitors and filters on the following pages are either solder-in mounting or threaded mounting styles to prevent spurious signals from entering or leaving a chassis, compartment or equipment.

CIRCUIT CONFIGURATIONS

C STYLE : Feed-Through Capacitor



π STYLE : Feed-Through Filter with 2 Capacitors & Ferrite



INSERTION LOSS

The insertion loss values given in the datasheets are measured in a 50 Ω -system at (25 \pm 2) $^{\circ}$ C. This method is consistent with MIL Std. 220 measurements.

RF CURRENT

The components on the following pages are designed primarily for DC power line filtering where RF currents do not exceed 0.3A. The limiting value of each type may be taken from the relevant data sheets.

PERMISSIBLE REACTIVE POWER

The maximum power ratings stated in the data sheets are valid when the component is mounted in a metal plate. When mounting the components into a PCB or self-supporting, the maximum reactive power must be limited to one-half.

SOLDERING

Mounting of the component should be achieved using a SN62/36/2AG type or a silver-bearing type solder, whereby solder wire, cream or preforms are acceptable. Only a mild active, resin flux should be used.

We recommend the use of a sink adjacent to the component body if possible.

As ceramic capacitors are very sensitive to rapid changes in temperature (thermal shock) a pre-heat and post-heat cycle is strongly recommended. Both the component and the ground plate should be heated up to 120 $^{\circ}$ C (heat must not be applied directly to the ceramic body and the temperature on the component surface should not be allowed to increase faster than 100 $^{\circ}$ C per minute). After the pre-heat cycle, the mounting plate temperature should be raised to achieve solder flow.

The solder flow state should be maintained for a minimum period (recommendation: less than 5s) and the tip temperature should be as low as possible (max. 260 $^{\circ}$ C). The assembly should be allowed to cool at a rate not exceeding 100 $^{\circ}$ C per minute.

CLEANING

The components should be cleaned immediately following the soldering operation with vapor degreasers.

MOUNTING

Mounting hardware such as threaded nuts are supplied in bulk, not assembled.

The mounting torques that are given in the datasheets must be observed. Exceeding these limiting values may result in damage to the ceramic body of the capacitors. Twisting or elongating the metal case by over-torquing will fracture the capacitor elements.

We do not recommend modifying the lead terminals, e.g. bending, cropping or cutting. This action could break the sealing or crack the ceramic insert. If however, the lead must be modified in that way, we recommend support of the lead with a clamping fixture next to the potted seal.

Ceramic Singlelayer Feed-Through Capacitors 400V_{DC}

DESIGN:

Feed-through capacitor solderable, varnished

RATED VOLTAGE U_R:

400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

1250V_{DC} 1s

DISSIPATION FACTOR tan δ:

Ceramic Class 1: see General Information

Ceramic Class 2: ≤ 25 • 10⁻³

INSULATION RESISTANCE R_{IS}:

Ceramic Class 1: ≥ 1 • 10¹⁰Ω

Ceramic Class 2: ≥ 5 • 10⁹Ω

CATEGORY TEMPERATURE RANGE ϑ_A:

Ceramic Class 1: (- 55 to + 125)°C

Ceramic Class 2: (- 25 to + 85)°C

CLIMATIC CATEGORY EN 60068-1:

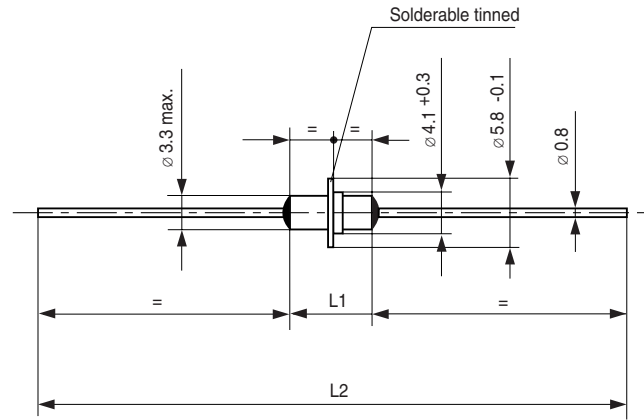
40 / 085 / 04

PERMISSIBLE REACTIVE POWER:

DDLK 0307: 4VAr (Class 2), 67VAr (Class 1)

DDLK 0312: 5.4VAr (Class 2), 90VAr (Class 1)

DDLK 0316: 7.1VAr (Class 2), 120VAr (Class 1)



• Dimensions in mm

	L ₁ (mm)	L ₂ (mm)
DDLK 0307	7	39 +1
DDLK 0312	12	65 +1
DDLK 0316	16	65 +1

PERMISSIBLE POWER LOSS:

DDLK 0307: 135mW

DDLK 0312: 135mW

DDLK 0316: 150mW

DIRECT CURRENT I_{DC}:

10A

MARKING:

none

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF)		
		DDLK 0307	DDLK 0312	DDLK 0316
1 B	P 100	1.5 to 10	to 12	to 36
	NP 0	5 to 15		
	N 075	5 to 20		
	N 150	6.8 to 20	to 62	to 100
	N 470	12 to 30		
1 F	N 750	20 to 62	to 130	to 200
	N 1500	68 to 100	to 150	to 180
2	R 700	180 to 360	to 680	to 1500
	R 2000	390 to 910	to 1600	to 3900
	R 4000	680 to 1800	to 3600	to 6800

CERAMIC DIELECTRIC	NOMINAL VALUE	CAPACITANCE TOLERANCE		
P 100 to N 750	< 10pF	± 0.5pF	± 1pF	
	≥ 10pF		± 10%	± 20%
R 700 to R 2000			- 20 + 50%	
R 4000 to R 6000			- 20 + 50%	- 20 + 80%

ORDERING INFORMATION				
DDLK 0307	400V _{DC}	680pF	- 20 + 50%	R 2000

Ceramic Singlelayer Feed-Through Capacitors 400V_{DC}

DESIGN:

Feed-through capacitor, threaded type

RATED VOLTAGE U_R:

400V_{DC} (175V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

550 V_{DC} 1s

DISSIPATION FACTOR tan δ:

Ceramic Class 1: see General Information
 Ceramic Class 2: $\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE Ri_s:

Ceramic Class 1: $\geq 1 \cdot 10^{10} \Omega$
 Ceramic Class 2: $\geq 5 \cdot 10^9 \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

Ceramic Class 1: (- 55 to + 125)°C
 Ceramic Class 2: (- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

40 / 085 / 21

PERMISSIBLE REACTIVE POWER:

5.4VAr (Class 2), 90VAr (Class 1)

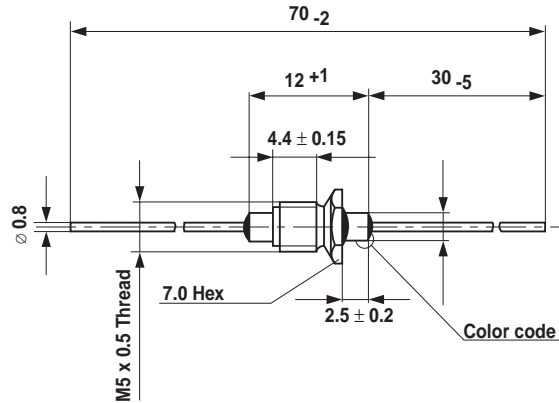
MARKING:

Capacitance value
 Ceramic dielectric color code

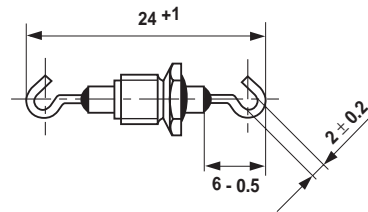
MAXIMUM PERMISSIBLE TORQUE:

0.6 Nm (clearance hole mounting)
 0.4 Nm (threaded hole mounting)

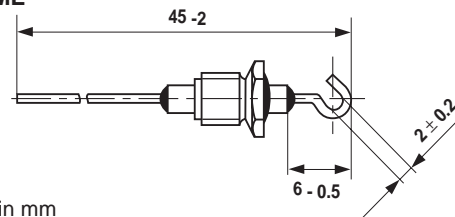
SERIES DDML



SERIES DZML



SERIES DUML



• Dimensions in mm

DIRECT CURRENT I_{DC}:

10A

MOUNTING HARDWARE:

A threaded nut (7.0 HEX) is supplied in bulk

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF)	TOLERANCE
1B	P 100	5	± 1pF
		10	± 20%
	N 150	25	± 20%
		60	± 20%
2	N 750	120	± 20%
	R 700	600	- 20 + 50%
	R 2000	1200	- 20 + 50%
	R 3000	3200	- 20 + 30%, - 20 + 50%

• other capacitance values are available on request

ORDERING INFORMATION					
DDML 0312	400V _{DC}	25pF	± 20%	N 150	

Ceramic Singlelayer Feed-Through Capacitors 400V_{DC}

DESIGN:

Feed-through capacitor, threaded type

RATED VOLTAGE U_R:

 400V_{DC} (175V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

 1250V_{DC} 1s

DISSIPATION FACTOR tan δ:

Ceramic Class 1: see General Information

 Ceramic Class 2: $\leq 25 \cdot 10^{-3}$
INSULATION RESISTANCE R_{is}:

 Ceramic Class 1: $\geq 1 \cdot 10^{10}\Omega$

 Ceramic Class 2: $\geq 5 \cdot 10^9\Omega$
CATEGORY TEMPERATURE RANGE ϑ_A :

Ceramic Class 1: (- 55 to + 125)°C

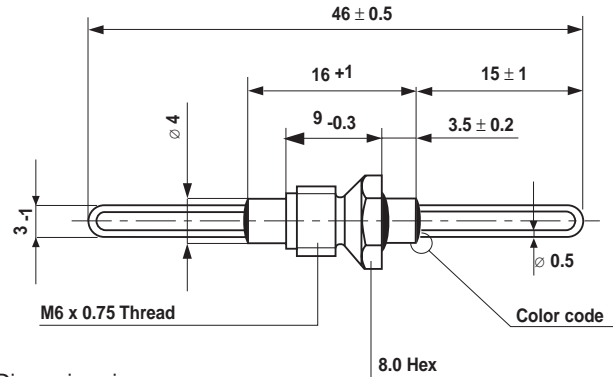
Ceramic Class 2: (- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

40 / 085 / 21

PERMISSIBLE REACTIVE POWER:

8.8VAr (Class 2), 150VAr (Class 1B ,1F)



• Dimensions in mm

DIRECT CURRENT I_{DC}:

8A

MAXIMUM PERMISSIBLE TORQUE:

0.8 Nm (clearance hole mounting)

0.5 Nm (threaded hole mounting)

PERMISSIBLE POWER LOSS:

220mW

MARKING:

Capacitance value, Tolerance letter,

Ceramic dielectric color code

MOUNTING HARDWARE:

A threaded nut (8.0 HEX) is supplied in bulk

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUE (pF)	TOLERANCE
1B	P 100	25	± 20%
	N 150	50	
	N 750	250	
1F	N 1500	400	- 20 + 50%
2	R 700	500	
	R 2000	2500	
	R 4000	5000	

• other capacitance values are available on request

ORDERING INFORMATION

DVML 0416

 400V_{DC}

5000pF

- 20 + 50%

R 4000

Ceramic Singlelayer Feed-Through Capacitors 400V_{DC}

DESIGN:

Feed-through capacitor, threaded type

RATED VOLTAGE U_R:

400V_{DC} (175V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

1250V_{DC} 1s

DISSIPATION FACTOR tan δ:

≤ 25 • 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 5 • 10⁹Ω

CATEGORY TEMPERATURE RANGE θ_A:

(- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

40 / 085 / 21

PERMISSIBLE REACTIVE POWER:

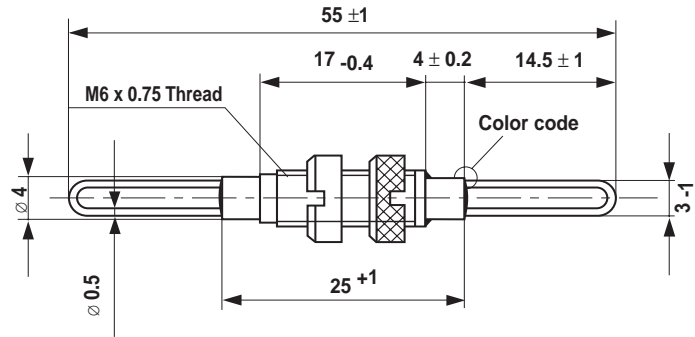
14VAr

DIRECT CURRENT I_{DC}:

8A

MAXIMUM PERMISSIBLE TORQUE:

0.8 Nm (clearance hole mounting)



* Dimensions in mm

PERMISSIBLE POWER LOSS:

340mW

MARKING:

Capacitance value, Tolerance letter,
Ceramic dielectric color code

MOUNTING HARDWARE:

Two threaded nuts (slotted or knurled) are supplied in bulk

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUE (μF)	TOLERANCE
2	R 4000	0.010	- 20 + 50%

• other capacitance values are available on request

ORDERING INFORMATION				
DVZL 0425	400V _{DC}	0.010μF	- 20 + 50%	R 4000

Ceramic Singlelayer Feed-Through Capacitors 400V_{DC}

DESIGN:

Feed-through capacitor, bushing-mount type

RATED VOLTAGE U_R:

 400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

 1250V_{DC} 1s

DISSIPATION FACTOR tan δ:

Ceramic Class 1: see General Information

 Ceramic Class 2: $\leq 25 \cdot 10^{-3}$
INSULATION RESISTANCE R_{is}:

 Ceramic Class 1: $\geq 1 \cdot 10^{10} \Omega$

 Ceramic Class 2: $\geq 5 \cdot 10^9 \Omega$
CATEGORY TEMPERATURE RANGE ϑ_A :

Ceramic Class 1: (- 55 to + 125)°C

Ceramic Class 2: (- 25 to + 85)°C

PERMISSIBLE REACTIVE POWER:

5.4VAr (Class 2), 100VAr (Class 1B,1F)

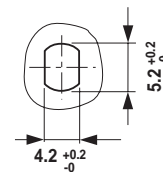
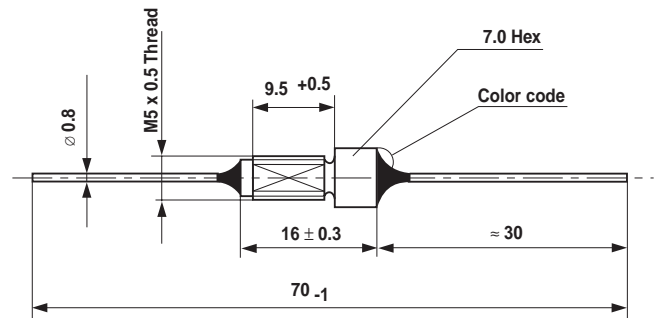
DIRECT CURRENT I_{DC}:

10A

MAXIMUM PERMISSIBLE TORQUE:

0.6 Nm (clearance hole mounting)

0.4 Nm (threaded hole mounting)



• Dimensions in mm

**Recommended
Mounting Hole**
PERMISSIBLE POWER LOSS:

150mW

MARKING:

 Capacitance value, Tolerance letter,
Ceramic dielectric color code

MOUNTING HARDWARE:

A threaded nut (7.0 HEX) is supplied in bulk

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF)	TOLERANCE
1B	P 100	47	± 10%, ± 20%
	N 470	68	
		75	
1F	N 750	100	
		150	
		200	
		220	
		240	
2	R 700	330	± 20%, - 20 + 50%
		470	
		680	
		1000	
		1500	
		2200	
	R 2000	1500	
R 4000	3300	- 20 + 50%, - 20 + 80%	
R 6000	4700		

• other capacitance values are available on request

ORDERING INFORMATION

DDML 0315	400V _{DC}	4700pF	- 20 + 80%	R 6000
-----------	--------------------	--------	------------	--------

Ceramic Singlelayer Feed-Through Capacitors 2000V_{DC}

DESIGN:

Feed-through capacitor, threaded type

RATED VOLTAGE U_R:

2000V_{DC}

DIELECTRIC STRENGTH BETWEEN LEADS:

3000V_{DC} 2s

DISSIPATION FACTOR tan δ:

≤ 25 • 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 5 • 10⁹Ω

CATEGORY TEMPERATURE RANGE ϑ_A:

(- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

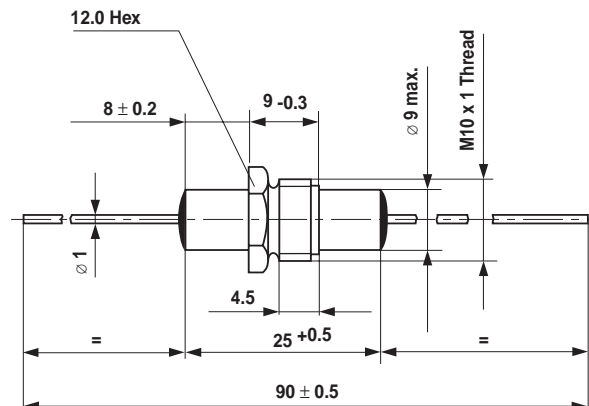
40 / 085 / 21

PERMISSIBLE REACTIVE POWER:

50VA_r

DIRECT CURRENT I_{DC}:

15A



* Dimensions in mm

MAXIMUM PERMISSIBLE TORQUE:

1.5 Nm (clearance hole mounting)

1.0 Nm (threaded hole mounting)

PERMISSIBLE POWER LOSS:

370mW

MARKING:

Capacitance value, Tolerance letter

MOUNTING HARDWARE:

A threaded nut (13.0 HEX) is supplied in bulk

CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUE (pF)	TOLERANCE
2	R 700	1000	± 20%
		1500	
	R 2000	2500	- 20 + 50%
		3300	

• other capacitance values are available on request

ORDERING INFORMATION

DDML 0825	2000V _{DC}	1500pF	- 20 + 50%	R 700
-----------	---------------------	--------	------------	-------

Ceramic Singlelayer Feed-Through Filters 400V_{DC}

DESIGN:

π-type feed-through filter solderable, varnished

RATED VOLTAGE U_R:

 400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

 1050V_{DC} 1s

DISSIPATION FACTOR tan δ:
 $\leq 25 \cdot 10^{-3}$
INSULATION RESISTANCE R_{is}:
 $\geq 5 \cdot 10^9 \Omega$
CATEGORY TEMPERATURE RANGE ϑ_A :

(- 25 to + 85) °C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

40 / 085 / 04

PERMISSIBLE REACTIVE POWER:

5.4VAr

PERMISSIBLE POWER LOSS:

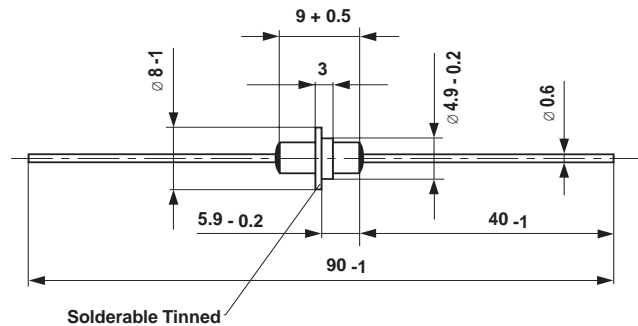
135mW

DIRECT CURRENT I_{DC}:

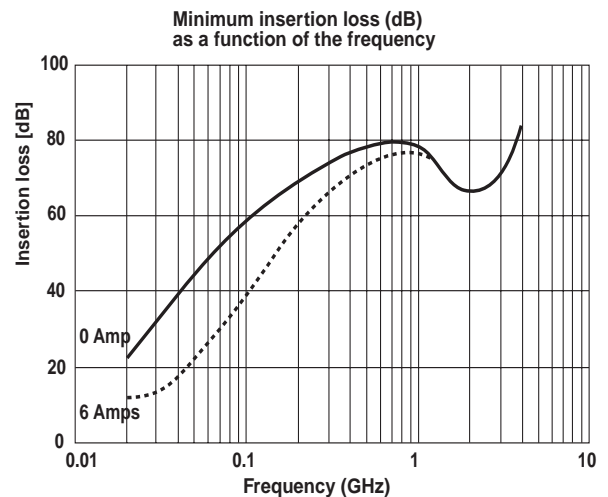
6A

MARKING:

none



• Dimensions in mm



CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUE (pF)	TOLERANCE
2	R 3000	1600	- 20 + 30%, - 20 + 50%

ORDERING INFORMATION				
DDNL 0409	400V _{DC}	1600pF	- 20 + 50%	R 3000

Ceramic Singlelayer Feed-Through Filters 200V_{DC}

DESIGN:

π -type feed-through filter solderable, threaded type

RATED VOLTAGE U_R:

200V_{DC} (140V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

600V_{DC} 1s

DISSIPATION FACTOR tan δ :

$\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE R_{is}:

$\geq 5 \cdot 10^9 \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

40 / 085 / 21

PERMISSIBLE REACTIVE POWER:

5.0VAr

PERMISSIBLE POWER LOSS:

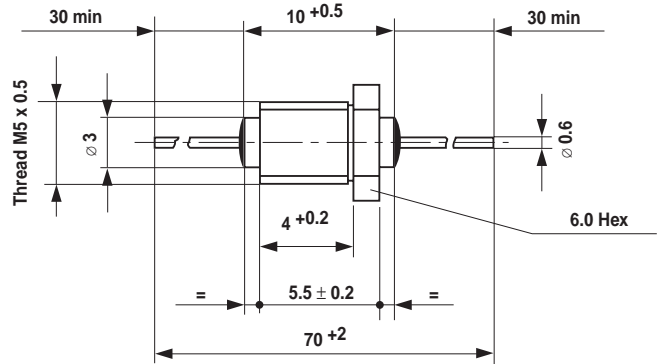
100mW

DIRECT CURRENT I_{DC}:

6A

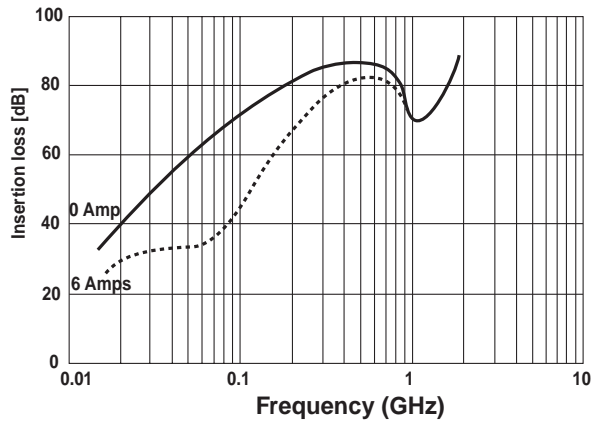
MARKING:

none



• Dimensions in mm

**Minimum insertion loss (dB)
as a function of the frequency**



CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUE (pF)	TOLERANCE
2	R 6000	3000	- 0 + 100%

ORDERING INFORMATION

DDML 0310	200V _{DC}	3000pF	- 0 + 100%	R 6000
-----------	--------------------	--------	------------	--------

Ceramic Singlelayer Feed-Through Filters 200V_{DC}

DESIGN:

π -type feed-through filter, bushing-mount type

RATED VOLTAGE U_R :

200V_{DC} (up to + 85°C)

100V_{DC} (up to + 125°C)

DIELECTRIC STRENGTH BETWEEN LEADS:

600V_{DC} 1s

DISSIPATION FACTOR tan δ :

$\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE R_{is}:

$\geq 1 \cdot 10^9 \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

40 / 085 / 56

PERMISSIBLE REACTIVE POWER:

5.4VAr

DIRECT CURRENT I_{DC}:

10A

MARKING:

Capacitance value, Tolerance letter,

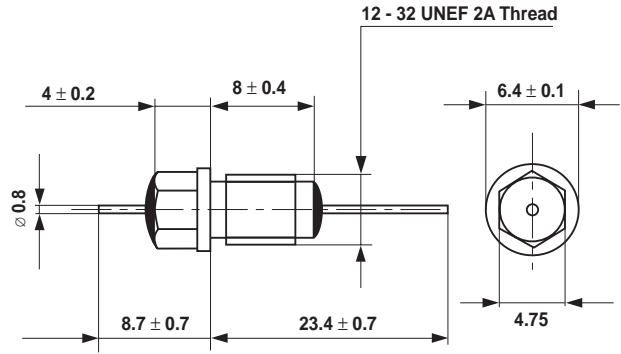
MAXIMUM PERMISSIBLE TORQUE:

0.6 Nm (clearance hole mounting)

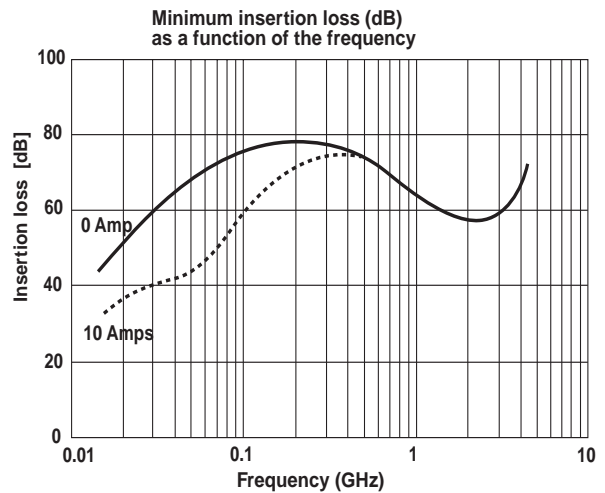
0.4 Nm (threaded hole mounting)

MOUNTING HARDWARE:

A threaded nut (0.250 HEX) & tooth washer are supplied in bulk



• Dimensions in mm



CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUES (pF)	TOLERANCE
2	R 6000	5000	- 20 + 80%

ORDERING INFORMATION				
DDMZ 0312	200V _{DC}	5000pF	- 20 + 80%	R 6000

Ceramic Singlelayer Feed-Through Filters 400V_{DC}

DESIGN:

π-type feed-through filter, threaded type

RATED VOLTAGE U_R:

400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

1250V_{DC} 1s

DISSIPATION FACTOR tan δ:

≤ 25 • 10⁻³

INSULATION RESISTANCE R_{is}:

≥ 5 • 10⁹Ω

CATEGORY TEMPERATURE RANGE θ_A:

(- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

40 / 085 / 21

PERMISSIBLE REACTIVE POWER:

5.4VAr

PERMISSIBLE POWER LOSS:

135mW

DIRECT CURRENT I_{DC}:

6A

MARKING:

None

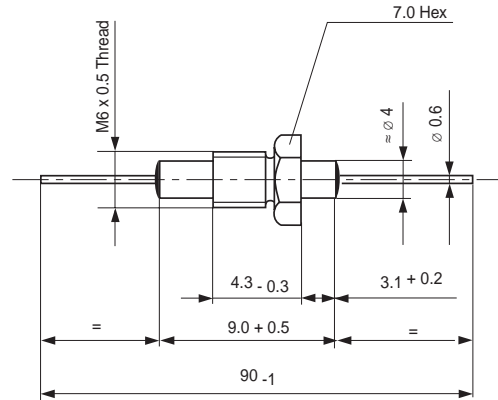
MAXIMUM PERMISSIBLE TORQUE:

0.8 Nm (clearance hole mounting)

0.5 Nm (threaded hole mounting)

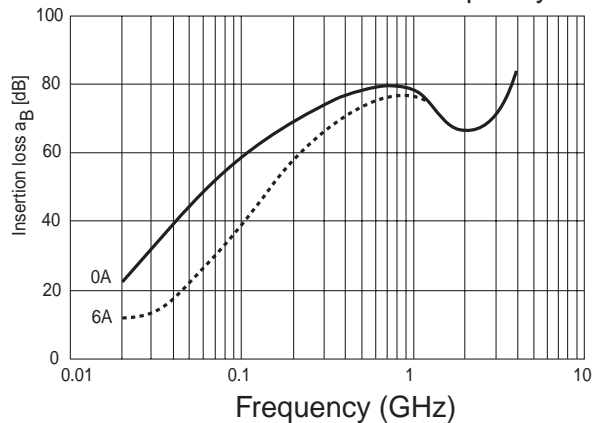
MOUNTING HARDWARE:

A threaded nut (8.0 HEX) is supplied in bulk



• Dimensions in mm

Minimal insertion loss (dB)
as a function of the frequency



CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUE (pF)	TOLERANCE
2	R 4000	1600	- 20 + 50%

ORDERING INFORMATION

DDML 0409	400V _{DC}	1600pF	- 20 + 50%	R 4000
-----------	--------------------	--------	------------	--------

Ceramic Singlelayer Feed-Through Filters 400V_{DC}

DESIGN:

π-type feed-through filter, threaded type

RATED VOLTAGE U_R:

 400V_{DC} (280V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS:

 1250V_{DC} 1s

DISSIPATION FACTOR tan δ:
 $\leq 25 \cdot 10^{-3}$
INSULATION RESISTANCE R_{is}:
 $\geq 5 \cdot 10^9 \Omega$
CATEGORY TEMPERATURE RANGE ϑ_A :

(- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1:

40 / 085 / 21

PERMISSIBLE REACTIVE POWER:

 8.8VA_r
PERMISSIBLE POWER LOSS:

220mW

DIRECT CURRENT I_{DC}:

10A

MARKING:

None

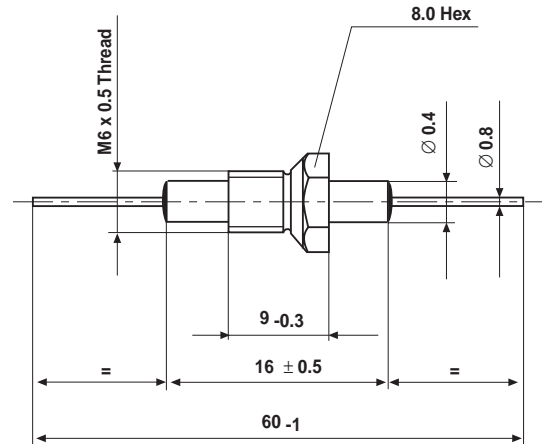
MAXIMUM PERMISSIBLE TORQUE:

0.8 Nm (clearance hole mounting)

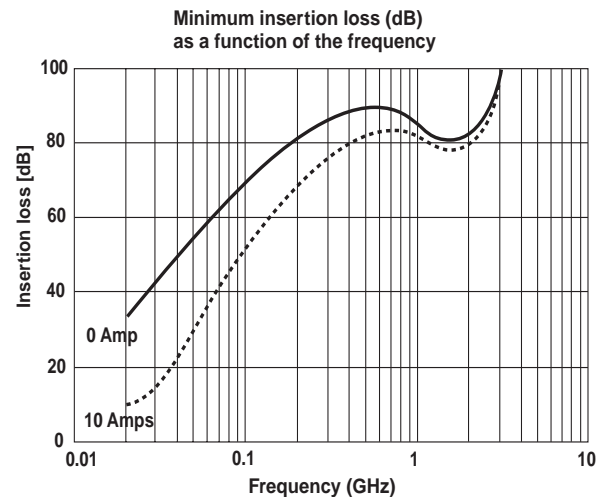
0.5 Nm (threaded hole mounting)

MOUNTING HARDWARE:

A threaded nut (8.0 HEX) is supplied in bulk



• Dimensions in mm



CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUE (pF)	TOLERANCE
2	R 3000	3200	- 20 + 30%

ORDERING INFORMATION

DDML 0416	400V _{DC}	3200pF	- 20 + 30 %	R 3000
-----------	--------------------	--------	-------------	--------

Ceramic Singlelayer Feed-Through Filters 400V_{DC}

DESIGN :

π-type feed-through filter, threaded type

RATED VOLTAGE U_R :

400V_{DC} (280 Vrms)

DIELECTRIC STRENGTH BETWEEN LEADS:

1250 V_{DC} 1s

DISSIPATION FACTOR tan δ :

≤ 25 • 10⁻³

INSULATION RESISTANCE R_{is} :

≥ 5 • 10⁹Ω

CATEGORY TEMPERATURE RANGE θ_A :

(- 25 to + 85)°C

CLIMATIC TESTING CLASS ACC. TO EN 60068-1 :

40 / 085 / 21

PERMISSIBLE REACTIVE POWER :

10.8VAr

PERMISSIBLE POWER LOSS :

270mW

DIRECT CURRENT I_{DC} :

10A

MARKING :

None

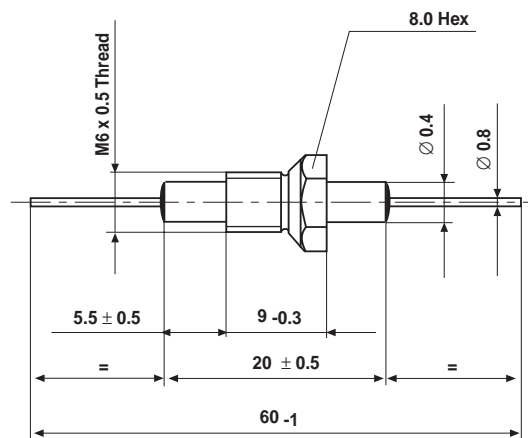
MAXIMUM PERMISSIBLE TORQUE

0.8 Nm (clearance hole mounting)

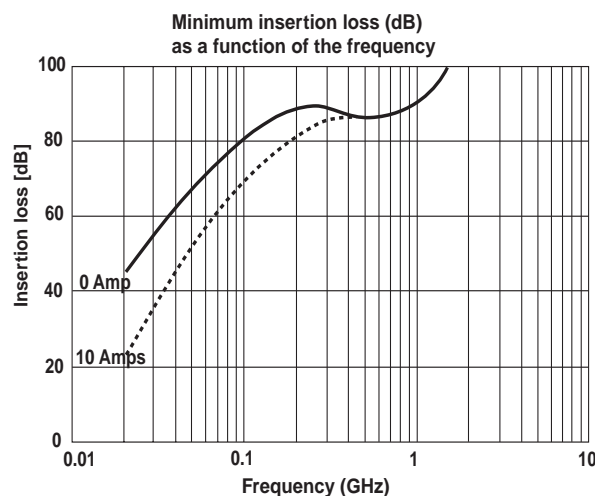
0.5 Nm (threaded hole mounting)

MOUNTING HARDWARE :

A threaded nut (8.0 HEX) is supplied in bulk



• Dimensions in mm



CLASS	CERAMIC DIELECTRIC	CAPACITANCE VALUE (pF)	TOLERANCE
2	R 3000	7000	- 20 + 30 %

ORDERING INFORMATION				
DDML 0420	400V _{DC}	7000pF	- 20 + 30 %	R 3000





Ceramic Capacitor Stacks & Voltage Multiplier Sets

SERIES	DESIGN	U_R	CAPACITANCE RANGE	PAGE
GDMQ ... GFMQ ... GFWQ ... GFMM ...	Capacitor Stacks	8kVp to 19kVp per single disc	125pF to 2200pF per single disc	100
RHK ...	Voltage Multiplier Sets			103

Ceramic Capacitor Stacks for Voltage Multiplier Circuits

PRODUCT DESCRIPTION:

Ceramic capacitor stacks are used mainly in modern high voltage supplies e.g. in X-ray machines for medical applications, industrial radiography (flaw detection, baggage examination, etc.) or in electrostatic powder coating equipment.

A high frequency generator (about 20kHz) supplies the input a.c. voltage via a ferrite transformer to the multiplier circuit.

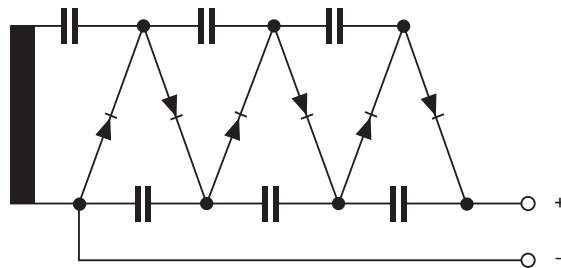
Output in excess of 100KV_{DC} can be produced depending on the number of switching steps.

VISHAY DRALORIC can supply the capacitor stacks for the voltage multiplier circuits to customers specified designs and requirements. The capacitor stacks and associated high voltage diodes are usually operated in high insulation environments such as oil or inert gas (sulphur hexafluoride SF₆) or are embedded in epoxy resin.

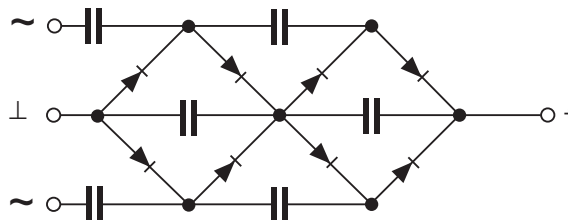
The number of individual capacitors in each stack and certain technical parameters can be varied to meet customer requirements within specified limits.

TYPICAL SCHEMATIC DIAGRAM

Half-wave-multiplier



Full-wave-multiplier



Ceramic Capacitors Stacks

DESIGN:

Ceramic capacitor stacks with leads

RATED VOLTAGE U_R :

see table below

DIELECTRIC STRENGTH:

see table below (Test voltage between leads)

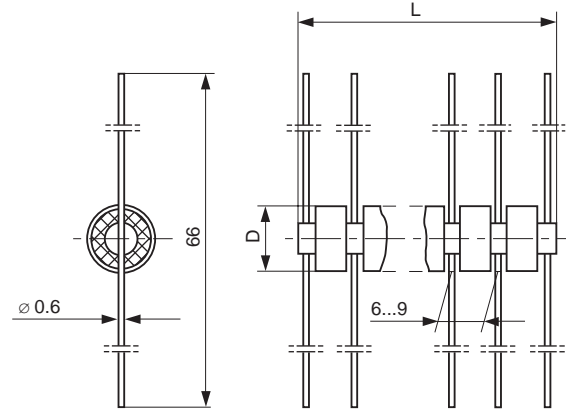
DISSIPATION FACTOR $\tan \delta$:

$\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE R_{is} :

$\geq 1 \cdot 10^{11} \Omega$ (R 2000, R 3000)

$\geq 1 \cdot 10^{10} \Omega$ (R 2005, R 6000)



• Dimensions in mm

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 10 to + 85) °C

MODEL	CAPACITANCE (pF)	TOLERANCE	RATED VOLTAGE* (kVp)	TEST VOLTAGE** (kV _{DC})	CERAMIC DIELECTRIC	NO. OF DISCS IN SERIES	LENGTH L (mm)	ØD (mm)
GDMQ 0803	125	- 20 + 40%	8	12	R 2000	3	22 MAX.	8.8 - 0.4
GDMQ 0806						6	40 MAX.	
GDMQ 0807						7	46 MAX.	
GDMQ 0809						9	61 MAX.	
GDMQ 0704	250	- 20 + 40 %	8	13	R 2005	4	25 MAX.	7.7 ± 0.2
GDMQ 0705						5	31 MAX.	
GDMQ 0706						6	37 MAX.	
GDMQ 0709						9	56 MAX.	
GDMQ 0710						10	62 MAX.	
GDMQ 0712	12	72 MAX.						
GDMQ 0803	250	- 20 + 40 %	8	13	R 3000	3	25 MAX.	8.8 - 0.4
GDMQ 0804						4	29 MAX.	
GDMQ 0805						5	35 MAX.	
GDMQ 0806						6	42.5 MAX.	
GDMQ 0809						9	61 MAX.	
GDMQ 0812						12	81 MAX.	
GDMQ 1005	500	- 20 + 40%	10	15	R 6000	5	47 MAX.	10.5 ± 0.4

*In an insulating environment

**Min. 3s in an insulating liquid

Other capacitance values and number of discs are available on request

ORDERING INFORMATION

GDMQ 0803	8kVp	125pF	- 20 + 40%	R 2000
-----------	------	-------	------------	--------

Ceramic Capacitor Stacks

DESIGN :

Ceramic capacitor stacks with solder tags

RATED VOLTAGE U_R :

see table below

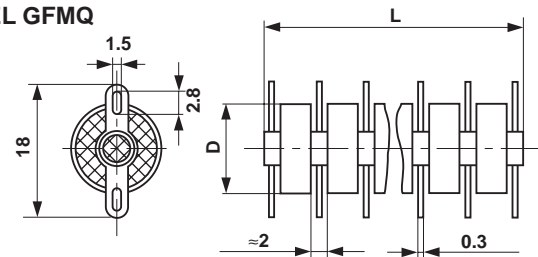
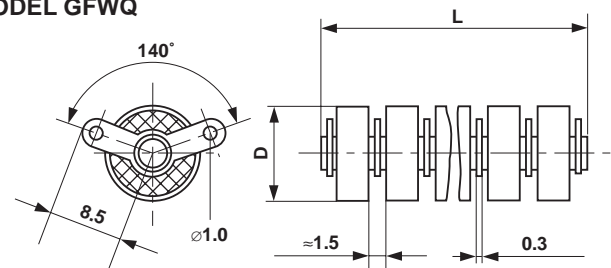
DIELECTRIC STRENGTH:

see table below (Test voltage between solder tags)

DISSIPATION FACTOR $\tan \delta$:
 $\leq 25 \cdot 10^{-3}$
INSULATION RESISTANCE R_{is} :
 $\geq 1 \cdot 10^{10} \Omega$ (R 2005)

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 10 to + 85) °C

MODEL GFMQ

MODEL GFWQ


• Dimensions in mm

MODEL	CAPACITANCE (pF)	TOLERANCE	RATED VOLTAGE* (kVp)	TEST VOLTAGE** (kV _{DC})	CERAMIC DIELECTRIC	NO. OF DISCS IN SERIES	LENGTH L (mm)	ØD (mm)
GFMQ 1010	370	± 20 %	8	13	R 2005	10	61 MAX.	10.5 ± 0.3
GFWQ 1010						10	61 MAX.	
GFMQ 1012						12	74 MAX.	
GFWQ 1012						12	74 MAX.	
GFMQ 1208	500	± 20 %	8	13	R 2005	8	51 MAX.	12.0 ± 0.2
GFWQ 1208						8	51 MAX.	
GFMQ 1210						10	65 MAX.	
GFWQ 1210						10	65 MAX.	
GFMQ 1212						12	74 MAX.	
GFWQ 1212						12	74 MAX.	

*In an insulating environment

**Min. 3s in an insulating liquid

Other capacitance values and number of discs are available on request

ORDERING INFORMATION

GFWQ 1212	8kVp	500pF	± 20%	R 2005
-----------	------	-------	-------	--------

Ceramic Capacitors Stacks

DESIGN:

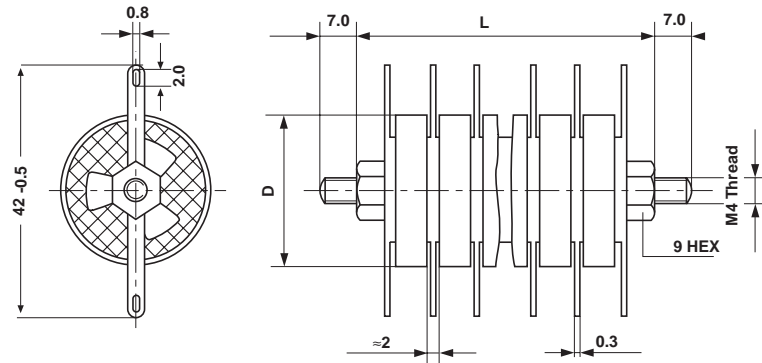
Ceramic capacitor stacks with solder tags and protective lacquering

RATED VOLTAGE U_R :

see table below

DIELECTRIC STRENGTH:

see table below (Test voltage between solder tags)



Insulating rim of the ceramic discs has protective lacquering
 • Dimensions in mm

DISSIPATION FACTOR $\tan \delta$:

$\leq 25 \cdot 10^{-3}$

INSULATION RESISTANCE R_{is} :

$\geq 1 \cdot 10^{10} \Omega$

CATEGORY TEMPERATURE RANGE ϑ_A :

(- 10 to + 60)°C

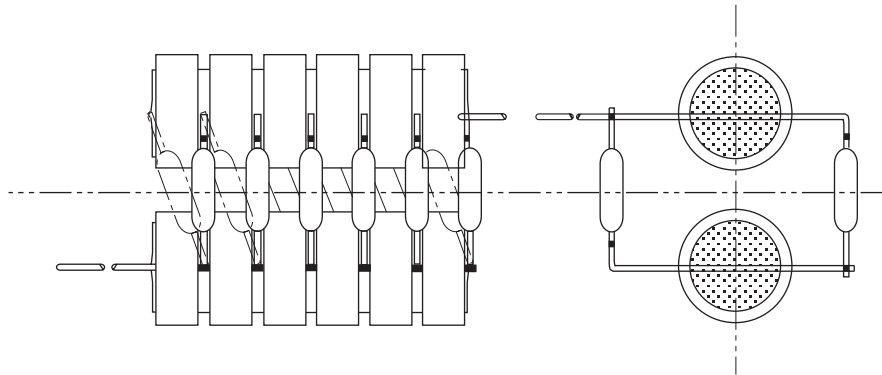
MODEL	CAPACITANCE (pF)	TOLERANCE	RATED VOLTAGE* (kVp)	TEST VOLTAGE** (kV _{DC})	CERAMIC DIELECTRIC	NO. OF DISCS IN SERIES	LENGTH L (mm)	ØD (mm)
GFMM 2505	1300	- 10 + 60%	19	25	R 4000	5	70 MAX.	25.5 ± 0.5
GFMM 2505	2200	- 10 + 50%	11	15	R 6000	5	70 MAX.	25.5 ± 0.5
GFMM 2507						7		

*In an insulating environment
 **Min. 20s in an insulating liquid

Other capacitance values and number of discs are available on request

ORDERING INFORMATION				
GFMM 2505	11kVp	2200pF	- 20 + 50%	R 6000

Voltage Multiplier Sets



VOLTAGE MULTIPLIER SETS

Vishay Draloric have the facilities to produce custom style Voltage Multiplier Sets:

- build up from two or more stacks
- completely soldered with diodes and resistors

The RHK... Cascade above, shows an example of 2 stacks complete with diode.

If you have an application with a non-standard requirement, contact us and our design team will work with you to find a solution.





PRODUCT	PAGE NO:	PRODUCT	PAGE NO:		
DDLK 03	Feed-Through Capacitor	85	HGZ	High Voltage Disc, Class 2	30
DDML 0310 ..	Feed-Through Filter	92	HHZ	High Voltage Disc, Class 2	30
DDML 0312 ..	Feed-Through Capacitor	86	HIK	Pulse Disc, Class 2	36
DDML 0409 ..	Feed-Through Filter	94	HIZ	High Voltage Disc, Class 2	30
DDML 0416 ..	Feed-Through Filter	95	HSE	Disc Capacitor, Class 2	26
DDML 0420 ..	Feed-Through Filter	96	HSZ	Disc Capacitor, Class 2	26
DDML 0825 ..	Feed-Through Capacitor	90	IBC	Pulse Disc, Class 2	38
DDMZ 0312 .	Feed-Through Filter	93	IEL	Pulse Disc, Class 1	34
DDMZ 0315 .	Feed-Through Capacitor	89	MDLL 02	Tubular Capacitor Set	81
DDNL 0409 ..	Feed-Through Filter	91	MDLL 03	Tubular Capacitor Set	81
DUML 0312 ..	Feed-Through Capacitor	86	MDLL 04	Tubular Capacitor Set	81
DVML 0416 ..	Feed-Through Capacitor	87	MDLT 02	Tubular Capacitor Set	81
DVZL 0425 ...	Feed-Through Capacitor	88	MDLT 03	Tubular Capacitor Set	81
DZML 0312 ..	Feed-Through Capacitor	86	MDLT 04	Tubular Capacitor Set	81
GDMQ	Capacitor Stack	100	RDLL 02	Tubular Capacitor, 160V _{DC}	75
GFMM	Capacitor Stack	102	RDLL 02	Tubular Capacitor, 400V _{DC}	76
GFMQ	Capacitor Stack	101	RDLL 03	Tubular Capacitor, 400V _{DC}	77
GFWQ	Capacitor Stack	101	RDLL 03	Tubular Capacitor, Class 1A	78
HAE	High Voltage Disc, Class 2	30	RDLL 04	Tubular Capacitor, 700V _{DC}	80
HAK	Pulse Disc, Class 2	36	RDLT 02	Tubular Capacitor, 160V _{DC}	75
HAU	High Voltage Disc, Class 1	28	RDLT 02	Tubular Capacitor, 400V _{DC}	76
HAX	High Voltage Disc, Class 2	30	RDLT 03	Tubular Capacitor, 400V _{DC}	77
HAZ	High Voltage Disc, Class 2	30	RDLT 03	Tubular Capacitor, Class 1A	78
HBE	High Voltage Disc, Class 2	30	RDLT 04	Tubular Capacitor, 700V _{DC}	80
HBK	Pulse Disc, Class 2	36	RDPT 02	Tubular Capacitor, Class 1 & 2	74
HBU	High Voltage Disc, Class 1	28	RDQL 03	Tubular Capacitor, Kzk	79
HBX	High Voltage Disc, Class 2	30	RDQT 03	Tubular Capacitor, Kzk	79
HBZ	High Voltage Disc, Class 2	30	RHK	Voltage Multiplier Set	103
HCE	High Voltage Disc, Class 2	30	RLA	Disc Capacitor, Class 1	22
HCK	Pulse Disc, Class 2	36	RLC	Disc Capacitor, Class 1	22
HCU	High Voltage Disc, Class 1	28	RLK	Disc Capacitor, Class 1	22
HCX	High Voltage Disc, Class 2	30	RLP	Disc Capacitor, Class 1	22
HCZ	High Voltage Disc, Class 2	30	RLU	Disc Capacitor, Class 1	22
HDE	High Voltage Disc, Class 2	30	RLV	Disc Capacitor, Class 1	22
HDU	High Voltage Disc, Class 1	28	VKO	AC Disc Capacitor, X1 & Y2	46
HEE	High Voltage Disc, Class 2	30	VKP	AC Disc Capacitor, X1 & Y1	50
HEU	High Voltage Disc, Class 1	28	W1X	Suppression Disc Capacitor, X1	42
HFE	High Voltage Disc, Class 2	30	WKO	AC Disc Capacitor, X1 & Y2	48
HFU	High Voltage Disc, Class 1	28	WKP	AC Disc Capacitor, X1 & Y1	52
HFZ	High Voltage Disc, Class 2	30	WYO	AC Disc Capacitor, X1 & Y2	44



ONLINE INFORMATION

For product information and a current list of sales offices,
representatives and distributors, visit our website:

www.vishay.com

WORLDWIDE SALES CONTACTS

THE AMERICAS

UNITED STATES

VISHAY AMERICAS
ONE GREENWICH PLACE
SHELTON, CT 06484
UNITED STATES
PH: +1-402-563-6866
FAX: +1-402-563-6296

ASIA

SINGAPORE

VISHAY INTERTECHNOLOGY
ASIA PTE LTD.
25 TAMPINES STREET 92
KEPPEL BUILDING #02-00
SINGAPORE 528877
PH: +65-6788-6668
FAX: +65-6788-0988

P.R. CHINA

VISHAY TRADING (SHANGHAI) CO., LTD.
15D, SUN TONG INFOPORT PLAZA
55 HUAI HAI WEST ROAD
SHANGHAI 200030
P.R. CHINA
PH: +86-21-5258-5000
FAX: +86-21-5258-7979

JAPAN

VISHAY JAPAN CO., LTD.
MG IKENOHATA BLDG. 4F
1-2-18, IKENOHATA
TAITO-KU
TOKYO 110-0008
JAPAN
PH: +81-3-5832-6210
FAX: +81-3-5832-6260

EUROPE

GERMANY

VISHAY EUROPE SALES GMBH
GEHEIMRAT-ROSENTHAL-STR. 100
95100 SELB
GERMANY
PH: +49-9287-71-0
FAX: +49-9287-70435

FRANCE

VISHAY S.A.
199, BLVD DE LA MADELEINE
06003 NICE, CEDEX 1
FRANCE
PH: +33-4-9337-2920
FAX: +33-4-9337-2997

UNITED KINGDOM

VISHAY LTD.
PALLION INDUSTRIAL ESTATE
SUNDERLAND SR4 6SU
UNITED KINGDOM
PH: +44-191-514-4155
FAX: +44-191-567-8262

One of the World's Largest Manufacturers of
Discrete Semiconductors and Passive Components

**World Headquarters**

Vishay Intertechnology, Inc.
63 Lancaster Avenue
Malvern, PA 19355-2143
United States

One of the World's Largest Manufacturers of
Discrete Semiconductors and Passive Components

© Copyright 2008 Vishay Intertechnology, Inc.
® Registered trademarks of Vishay Intertechnology, Inc.
All rights reserved. Printed in Germany.
Specifications subject to change without notice.

www.vishay.com