Lower Voltage Ceramic Singlelayer DC Disc Capacitors 1 kV_{DC} to 3 kV_{DC} Low Dissipation Factor

QUICK REFERENCE DATA			
DESCRIPTION	VALUE		
Ceramic Class	1		
Ceramic Dielectric	C0G, N1500, N2000, N2200, N2500, N2800		
Voltage (V_{DC})	1000	2000	3000
Min. Capacitance (pF)	10	10	10
Max. Capacitance (pF)	6800	6800	4700
Mounting	Radial		

INSULATION RESISTANCE

Min. 50 000 MΩ

TOLERANCE ON CAPACITANCE

± 5 %, ± 10 %

DISSIPATION FACTOR

0.1 % max. at 1 kHz; 1 V

CATEGORY TEMPERATURE RANGE

-55 °C to +125 °C

CLIMATIC CATEGORY ACC. TO EN 60068-1

55/125/21

OPERATING TEMPERATURE RANGE

-55 °C to +105 °C (1)

Note

(1) For explanation about the difference of operating temperature range and temperature characteristic of capacitance, please see www.vishay.com/doc?48299

FEATURES

RoHS COMPLIANT

- Low losses
- High stability
- Low DF minimizes self heating at HF
- Ideal for high switching to 100 kHz
- Radial leads
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912

APPLICATIONS

- Switching power supplies
- HF ballast
- Snubber and HV circuits

DESIGN

The capacitors consist of a ceramic disc of which both sides are silver-plated. Connection leads are made of tinned copper having diameters of 0.022" (0.51 mm) or 0.025" (0.64 mm).

The capacitors may be supplied with radial kinked or straight leads having lead spacing of 0.250" (6.35 mm) or 0.375" (9.5 mm).

The standard tolerances are ± 5 %, ± 10 %.

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

CAPACITANCE RANGE

10 pF to 6800 pF

RATED VOLTAGE

1000 V_{DC} (500 V_{RMS})
2000 V_{DC} (1000 V_{RMS})
3000 V_{DC} (1500 V_{RMS})

DIELECTRIC STRENGTH BETWEEN LEADS

Component test, 100 % test at production line:

1000 V_{DC}	2500 V_{DC}, 2 s
2000 V_{DC}	4000 V_{DC}, 2 s
3000 V_{DC}	6000 V_{DC}, 2 s

CERAMIC DIELECTRIC

C0G, N1500, N2000, N2200, N2500, N2800 (Class 1)

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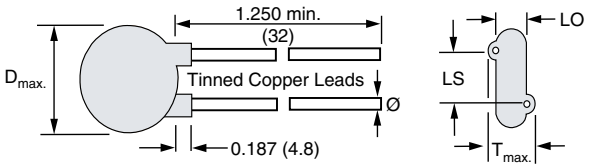
DIMENSIONS in inches (millimeters)

Fig. 1



ORDERING INFORMATION, CERAMIC 1 kV_{DC} LOW DISSIPATION FACTOR

C (pF)	TOL. (%)	$D_{max.}$ DIAMETER INCH (mm)	$T_{max.}$ THICKNESS INCH (mm)	LS LEAD SPACE INCH (mm) ± 1 mm	LO LEAD OFFSET INCH (mm) ± 0.5 mm	WIRE SIZE AWG	WIRE SIZE INCH (mm)	FIG.	ORDERING CODE
C0G (NP0)									
10	± 5	0.250 (6.4)	0.156 (4.0)	0.250 (6.4)	0.043 (1.1)	22	0.025 (0.64)	1	561R1DF0Q10
12					0.051 (1.3)				561R1DF0Q12
N1500									
22	± 5	0.250 (6.4)	0.156 (4.0)	0.250 (6.4)	0.043 (1.1)	22	0.025 (0.64)	1	561R1DF0Q22
47					0.071 (1.8)				561R1DF0Q47
56					0.055 (1.4)				561R1DF0Q56
68					0.059 (1.5)				561R1DF0Q68
82					0.047 (1.2)				561R1DF0Q82
N2200									
33	± 10	0.250 (6.4)	0.156 (4.0)	0.250 (6.4)	0.043 (1.1)	22	0.025 (0.64)	1	561R1DF0Q33
N2000									
100	± 10	0.250 (6.4)	0.156 (4.0)	0.250 (6.4)	0.059 (1.5)	22	0.025 (0.64)	1	561R1DF0T10
120					0.055 (1.4)				561R1DF0T12
150					0.043 (1.1)				561R1DF0T15
180					0.043 (1.1)				561R1DF0T18
N2500									
220	± 10	0.250 (6.4)	0.156 (4.0)	0.250 (6.4)	0.059 (1.5)	22	0.025 (0.64)	1	561R1DF0T22
270					0.043 (1.1)				561R1DF0T27
N2800									
330	± 10	0.250 (6.4)	0.156 (4.0)	0.250 (6.4)	0.047 (1.2)	22	0.025 (0.64)	1	561R1DF0T33
390					0.047 (1.2)				561R1DF0T39
470		0.290 (7.4)			0.059 (1.5)				561R1DF0T47
560					0.055 (1.4)				561R1DF0T56
680					0.047 (1.2)				561R1DF0T68
820					0.043 (1.1)				561R1DF0T82
1000		0.370 (9.4)			0.055 (1.4)				561R1DF0D10
1200					0.047 (1.2)				561R1DF0D12
1500		0.405 (10.3)			0.047 (1.2)				561R1DF0D15
1800		0.440 (11.2)			0.051 (1.3)				561R1DF0D18
2200		0.460 (11.7)			0.047 (1.2)				561R1DF0D22
2700		0.490 (12.4)			0.047 (1.2)				561R1DF0D27
3300		0.530 (13.5)			0.047 (1.2)				561R1DF0D33
3900		0.560 (14.2)	0.156 (4.0)	0.375 (9.5)	0.047 (1.2)				561R1DF0D39
4700		0.630 (16.0)			0.047 (1.2)				561R1DF0D47
5600		0.680 (17.3)			0.047 (1.2)				561R1DF0D56
6800		0.760 (19.3)			0.047 (1.2)				561R1DF0D68

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C (pF)	TOL. (%)	$D_{max.}$ DIAMETER INCH (mm)	$T_{max.}$ THICKNESS INCH (mm)	LS LEAD SPACE INCH (mm) ± 1 mm	LO LEAD OFFSET INCH (mm) ± 0.5 mm	WIRE SIZE		FIG.	ORDERING CODE
						AWG	INCH (mm)		
N1500									
33	± 5	0.290 (7.4)	0.195 (5.0)	0.250 (6.4)	0.098 (2.5)	20	0.032 (0.81)	1	564R2DF0Q33
39			0.180 (4.6)		0.083 (2.1)				564R2DF0Q39
47			0.170 (4.3)		0.071 (1.8)				564R2DF0Q47
N2000									
56	± 5	0.290 (7.4)	0.210 (5.3)	0.250 (6.4)	0.110 (2.8)	20	0.032 (0.81)	1	564R2DF0Q56
68			0.190 (4.8)		0.091 (2.3)				564R2DF0Q68
82			0.175 (4.5)		0.075 (1.9)				564R2DF0Q82
100			0.170 (4.3)		0.071 (1.8)				564R2DF0T10
N2500									
120	± 10	0.290 (7.4)	0.185 (4.7)	0.250 (6.4)	0.087 (2.2)	20	0.032 (0.81)	1	564R2DF0T12
150			0.170 (4.3)		0.071 (1.8)				564R2DF0T15
180			0.185 (4.7)		0.071 (1.8)				564R2DF0T18
270		0.330 (8.4)	0.170 (4.3)		0.079 (2.0)				564R2DF0T27
470		0.400 (10.2)	0.170 (4.3)		0.075 (1.9)				564R2DF0T47
N2800									
220	± 10	0.290 (7.4)	0.170 (4.3)	0.250 (6.4)	0.087 (2.2)	20	0.032 (0.81)	1	564R2DF0T22
330		0.330 (8.4)	0.185 (4.7)		0.083 (2.1)				564R2DF0T33
390		0.330 (8.4)	0.175 (4.5)		0.075 (1.9)				564R2DF0T39
560		0.400 (10.2)	0.185 (4.7)		0.087 (2.2)				564R2DF0T56
680		0.400 (10.2)	0.170 (4.3)		0.075 (1.9)				564R2DF0T68
820		0.430 (10.9)	0.175 (4.5)		0.075 (1.9)				564R2DF0T82
1000		0.460 (11.7)	0.170 (4.3)		0.075 (1.9)				564R2DF0D10
1500		0.530 (13.5)			0.071 (1.8)				564R2DF0D15
1800		0.560 (14.2)	0.170 (4.3)	0.375 (9.5)	0.071 (1.8)				564R2DF0D18
2200		0.680 (17.3)	0.180 (4.6)		0.083 (2.1)				564R2DF0D22
2300			0.175 (4.5)		0.079 (2.0)				564R2DF0D23
2400			0.175 (4.5)		0.075 (1.9)				564R2DF0D24
2700			0.170 (4.3)		0.071 (1.8)				564R2DF0D27
3300		0.720 (18.3)			0.071 (1.8)				564R2DF0D33
3900		0.790 (20.1)			0.075 (1.9)				564R2DF0D39
4700		0.900 (22.9)	0.180 (4.6)		0.083 (2.1)				564R2DF0D47
5600		0.900 (22.9)	0.170 (4.3)		0.075 (1.9)				564R2DF0D56
6800		0.950 (24.1)	0.170 (4.3)		0.071 (1.8)				564R2DF0D68

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C (pF)	TOL. (%)	$D_{max.}$ DIAMETER INCH (mm)	$T_{max.}$ THICKNESS INCH (mm)	LS LEAD SPACE INCH (mm) ± 1 mm	LO LEAD OFFSET INCH (mm) ± 0.5 mm	WIRE SIZE AWG	WIRE SIZE INCH (mm)	FIG.	ORDERING CODE
N1500									
10	± 5	0.290 (7.4)	0.185 (4.7)	0.250 (6.4)	0.087 (2.2)	20	0.032 (0.81)	1	564R3DF0Q10
27			0.220 (5.6)		0.122 (3.1)				564R3DF0Q27
33			0.195 (5.0)		0.098 (2.5)				564R3DF0Q33
39			0.190 (4.8)		0.094 (2.4)				564R3DF0Q39
47		0.330 (8.4)	0.225 (5.7)		0.126 (3.2)				564R3DF0Q47
N2200									
12	± 5	0.290 (7.4)	0.210 (5.3)	0.250 (6.4)	0.110 (2.8)	20	0.032 (0.81)	1	564R3DF0Q12
22		0.330 (8.4)	0.210 (5.3)		0.110 (2.8)				564R3DF0Q22
N2000									
56	± 5	0.290 (7.4)	0.210 (5.3)	0.250 (6.4)	0.110 (2.8)	20	0.032 (0.81)	1	564R3DF0Q56
68			0.190 (4.8)		0.098 (2.5)				564R3DF0Q68
82			0.185 (4.7)		0.091 (2.3)				564R3DF0Q82
N2500									
100	± 10	0.290 (7.4)	0.205 (5.2)	0.250 (6.4)	0.106 (2.7)	20	0.032 (0.81)	1	564R3DF0T10
120		0.290 (7.4)	0.190 (4.8)		0.091 (2.3)				564R3DF0T12
220		0.330 (8.4)	0.190 (4.8)		0.091 (2.3)				564R3DF0T22
N2800									
150	± 10	0.290 (7.4)	0.200 (5.1)	0.250 (6.4)	0.091 (2.3)	20	0.032 (0.81)	1	564R3DF0T15
180		0.290 (7.4)	0.190 (4.8)		0.091 (2.3)				564R3DF0T18
270		0.330 (8.4)	0.205 (5.2)		0.110 (2.8)				564R3DF0T27
330		0.330 (8.4)	0.190 (4.8)		0.091 (2.3)				564R3DF0T33
390		0.400 (10.2)	0.215 (5.5)		0.102 (2.6)				564R3DF0T39
470		0.400 (10.2)	0.195 (5.0)		0.087 (2.2)				564R3DF0T47
560		0.430 (10.9)	0.200 (5.1)		0.102 (2.6)				564R3DF0T56
680		0.460 (11.7)	0.195 (5.0)		0.087 (2.2)				564R3DF0T68
820		0.490 (12.5)	0.195 (5.0)		0.102 (2.6)				564R3DF0T82
1000		0.530 (13.5)	0.190 (4.8)		0.091 (2.3)				564R3DF0D10
1200		0.560 (14.2)	0.190 (4.8)	0.375 (9.5)	0.091 (2.3)				564R3DF0D12
1500		0.620 (15.8)			0.091 (2.3)				564R3DF0D15
1800		0.680 (17.3)			0.098 (2.5)				564R3DF0D18
2200		0.720 (18.3)			0.094 (2.4)				564R3DF0D22
2700		0.790 (20.1)	0.190 (4.8)		0.087 (2.2)				564R3DF0D27
3300		0.900 (22.9)	0.200 (5.1)		0.102 (2.6)				564R3DF0D33
4700		0.950 (24.1)	0.185 (4.7)		0.087 (2.2)				564R3DF0D47

TAPE AND REEL OPTIONS

Part number codes and specifications for tape and reel packaging are found in the general information document www.vishay.com/doc?23140.

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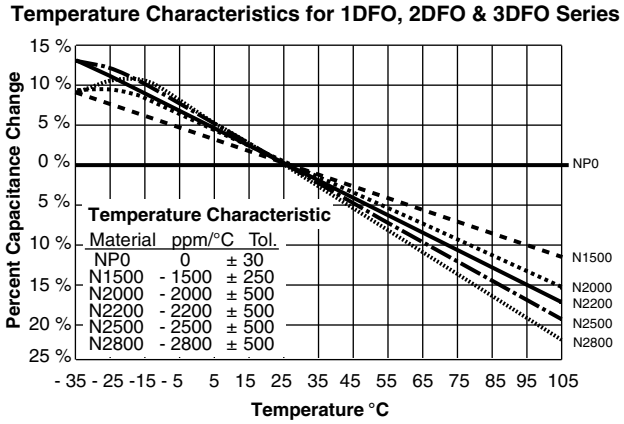
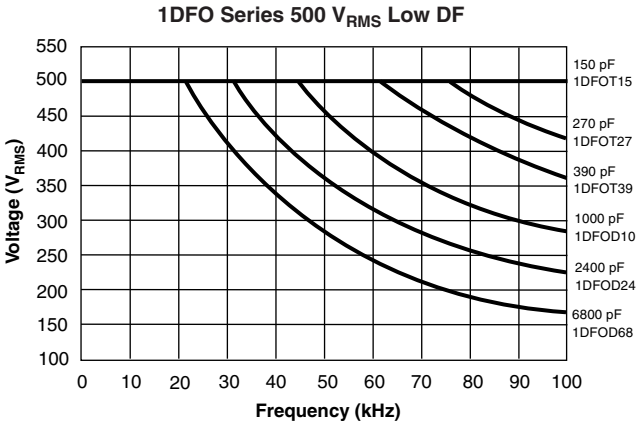
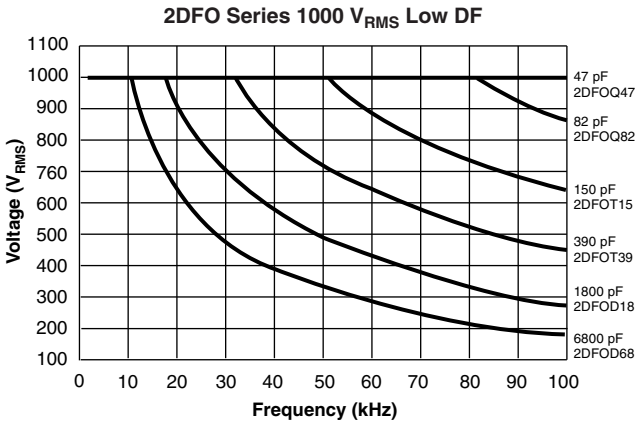
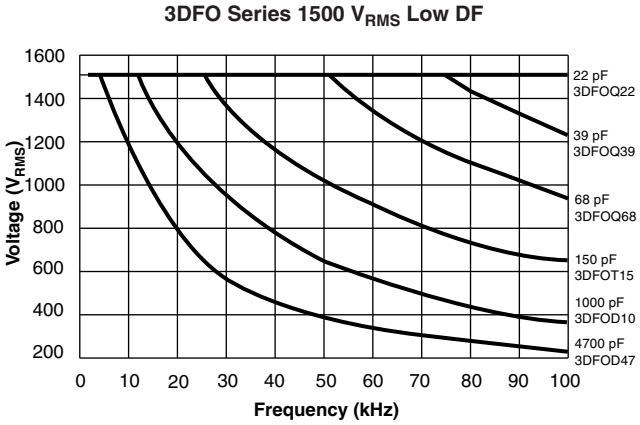
CAPACITANCE CHANGE VS. TEMPERATURE (TYPICAL)



POWER RATING







Notes

- Power ratings are based on still air 60 °C ambient with additional 30 °C rise due to self heating. Thermal effects such as forced air cooling, component encapsulation or other heat-sinking techniques will alter ratings. Actual circuit for application recommended
- For convenience, power rating charts are shown to 100 kHz. Higher frequency operation is permissible with appropriate derating. Consult us for application suggestions

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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 +40 °C, relative humidity up to 60 % RH). Class 2 ceramic dielectric capacitors are also subject to aging see general information (www.vishay.com/doc?23140).

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) s	(10 ± 1) s
Distance from component body	≥ 2 mm	≥ 5 mm

SOLDERING RECOMMENDATIONS

Ceramic capacitors are very sensitive to rapid changes in temperature (thermal shock) therefore the solder heat resistance specification (see table above) should not be exceeded. Exposing 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.

When soldering radial leaded ceramic capacitors with a soldering iron, it should be performed under the following conditions and should not exceed:

- Maximum temperature of iron-tip: 400 °C
- Maximum soldering iron wattage: 50 W
- Maximum soldering time: 3.5 s

Failure to follow the above cautions may result, in worst case, in short circuit or cause fuming or thermo-mechanical damage when the product is used.

Leaded ceramic capacitors are not designed for reflow process or dipping the body into a solder melt.

CLEANING

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

CLEANING (ULTRASONIC CLEANING)

To perform ultrasonic cleaning, observe the following conditions:

- Maximum rinse bath capacity output: 20 W/liter
- Maximum rinsing time: 300 s
- Do not vibrate the PCB/PWB directly
- Excessive ultrasonic cleaning may lead to mechanical damage

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. In order to avoid such failures we are offering different lead wire designs (e.g. straight, inline, inside crimp, outside crimp etc.) If however, the lead must be modified in any way, we recommend support of the lead with a clamping fixture next to the coating. If a defined product stop is required for mounting on a PCB, a mechanically formed product stop or a mounting tool should be used.

OPERATING VOLTAGE

In case the voltage is applied to the circuit, starting as well as stopping, may generate irregular voltage for a transit period because of resonance or switching. Be sure to use a capacitor with a rated voltage range that includes these irregular voltages.

RELATED DOCUMENTS	
General Information	www.vishay.com/doc?23140

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