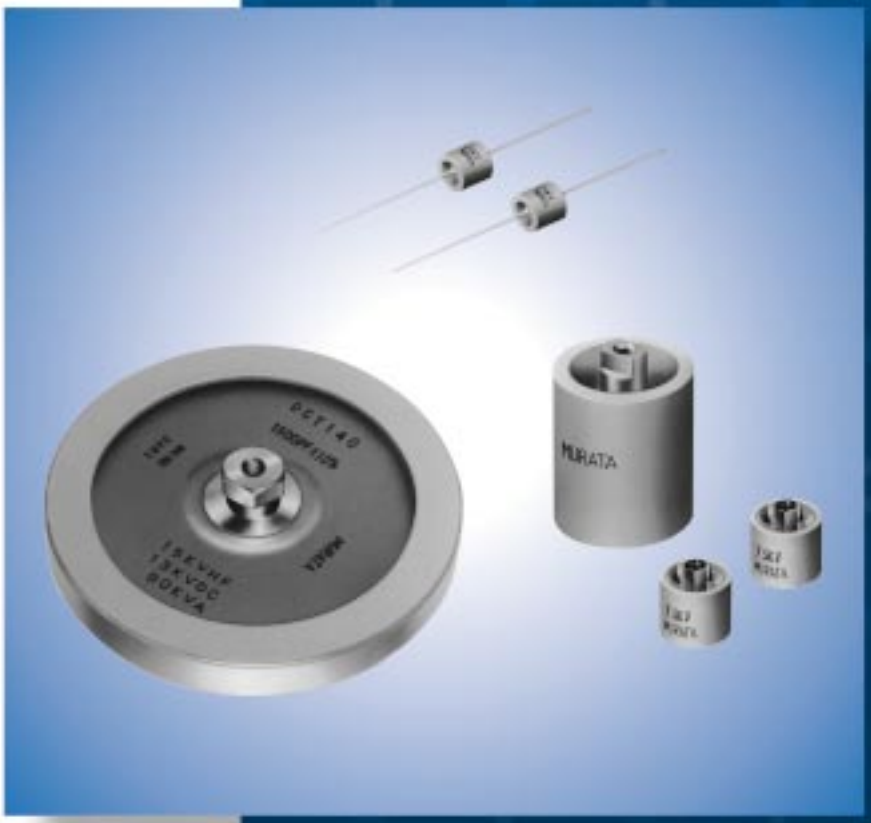
High Frequency Power Ceramic Capacitors



muRata Innovator in Electronics

Murata
Manufacturing Co., Ltd.

Cat.No.C42E-5

CONTENTS

Part Numbering

High Frequency Power Ceramic Capacitors

(Part Number) DC | T | 3U | F4 | 102 | K | B8 | B | ❶ ❷ ❸ ❹ ❺ ❻ ❼ ❽ ❾

❶Product ID

Product ID	
DC	High Frequency Power Ceramic Capacitors

❷Series Category

Code	Contents
A	Disc Type
T	Flange Type
5	Small Type

❸Temperature Characteristics

Code	Temp. Char.	Cap. Change or Temp. Coeff.
F3	F	+30%, −80%
1X	SL	+350 to −1000ppm/℃
2C	CH	0±60ppm/℃
3U	UJ	−750±120ppm/℃

❹Rated Voltage

Code	Rated Voltage
A3	H.F. Peak Value 1kVo-p
D3	H.F. Peak Value 2kVo-p
H3	H.F. Peak Value 5kVo-p
J3	H.F. Peak Value 6kVo-p
AR	H.F. Peak Value 7kVo-p
AT	H.F. Peak Value 9kVo-p
A4	H.F. Peak Value 10kVo-p
B4	H.F. Peak Value 12kVo-p
AF	H.F. Peak Value 14kVo-p
C4	H.F. Peak Value 15kVo-p
AX	H.F. Peak Value 16kVo-p
AK	H.F. Peak Value 22.5kVo-p
E4	H.F. Peak Value 25kVo-p
F4	H.F. Peak Value 30kVo-p
3E	DC2.5kV
3H	DC5kV
AD	DC7.5kV
4C	DC15kV
4D	DC20kV

❺Capacitance

Expressed by three figures. The unit is pico-farad (pF). The first and second figures are significant digits, and the third figure expresses the number of zeros which follow the two numbers. If there is a decimal point, it is expressed by the capital letter "**R**". In this case, all figures are significant digits.

❻Capacitance Tolerance

Code	Capacitance Tolerance
D	±0.5pF
K	±10%
M	±20%

❼Shape

Code	Shape	Series
A2/B2	Dia. 40mm	**DCA/DCT** Series
A3/B3	Dia. 60mm	
A4/B4	Dia. 80mm	
B5	Dia. 110mm	**DCT** Series
B6	Dia. 140mm	
B7	Dia. 160mm	
B8	Dia. 200mm	
C1	Dia. 12mm	**DC5** Series
C3	Dia. 6.3mm	
C4	Dia. 30mm	
C5	Dia. 48mm	
C6	Dia. 20mm	
C7	Dia. 7.5mm	
C8	Dia. 20mm	

❽Packaging

Code	Packaging
B	Bulk

❾Individual Specification

In case part number cannot be identified without "Individual Specification", it is added at the end of part number.

High Frequency Power Ceramic Capacitors

■ General Description

The high frequency power ceramic capacitors are designed for use in circuits that are subject to high frequency, high power applications or to DC or AC (commercial frequency) high voltage.

Typical applications are:

1. Oscillating circuits, resonance circuits, bypass capacitors, and coupling capacitors in various types of high frequency induction and dielectric heating equipment
2. Transmission line carrier coupling capacitors
3. Capacitors for capacitance voltage dividers
   This type of capacitor is especially indispensable for equipment handling high frequency power. In recent years, with the spread of high frequency application technology, the high frequency power ceramic capacitors are finding expanded applications.

■ Features

The outstanding features of our high frequency power ceramic capacitors are the result of our many years of manufacturing experience and the use of new technologies.

1. Small size and high capacitance
2. Linear and reversible temperature characteristic
3. Higher operating temperature ranges than other capacitors
4. High "Q" from low frequency to high frequency
5. Outstanding resistance to humidity and heat
   Virtually no performance deterioration after extended use.
6. Excellent high frequency operation due to small internal inductance

■ Power Capacity of Capacitors

The permissible apparent power through a ceramic capacitor is limited by the working voltage of the capacitor in the lower frequency region and by the permissible temperature rise in the higher frequency region.

1. Power Capacity in the Lower Frequency Region
   Every capacitor has a rated working voltage at which safe operation is guaranteed within a specified operating temperature range, because the applied voltage is generally limited by the specified rated voltage at low frequency, the apparent power which can be introduced into the capacitor is consequently limited.
   Assume the capacitance as C, DC voltage applied to the ceramic capacitor having a rated DC voltage E_D as e_D, high frequency voltage e_{HE} (effective value) that can be superimposed is given by the following formula:

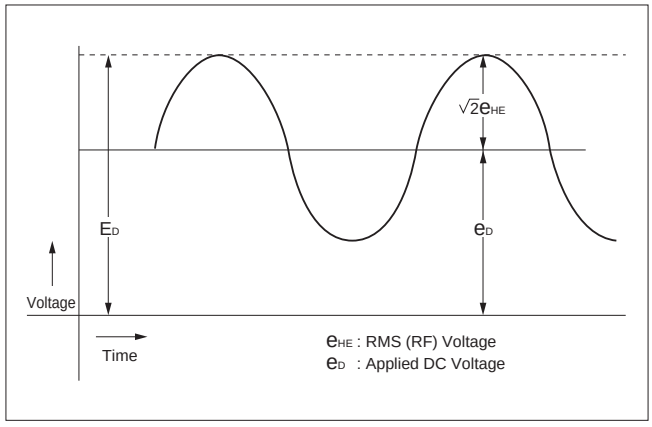
$$\sqrt{2}e_{HE} \leqq E_D - e_D$$

   Therefore, at frequency f, the apparent power W_L that can be introduced into the capacitor is:

$$W_L = e^2_{HE} \cdot 2\pi f \cdot C$$
$$= \frac{(E_D - e_D)^2}{2} \cdot 2\pi f \cdot C$$
$$= (E_D - e_D)^2 \cdot \pi f \cdot C$$

   The apparent power is proportional to the frequency f when E_D and e_D are constant.
   The maximum current that flows through the capacitor is given by:

$$i = 2\pi f \cdot C \cdot e_{HE}$$
$$= 2\pi f \cdot C \cdot \frac{(E_D - e_D)}{\sqrt{2}}$$
$$= \sqrt{2}\pi f \cdot C \cdot (E_D - e_D)$$



High Frequency Power Ceramic Capacitors

2. Power Capacity in the Higher Frequency Region

The allowable power of the ceramic capacitor in the higher frequency region is generally limited by heating due to dielectric losses and temperature rise caused by heating, due to Joule heat at areas where the terminals are connected to the electrodes.

Thus, the permissible power at high frequencies is limited by the allowable internal temperature rise. The permissible power is increased as the internal temperature rises.

For example, when a high frequency voltage of frequency f is applied to a capacitor of capacitance C, the heat generated from dielectric loss is expressed by:

$$W_{r1} = DF \cdot W_L$$
$$= DF \cdot 2\pi f \cdot C \cdot e^2_{HE}$$
$$= DF \cdot \frac{i^2}{C \cdot 2\pi f} \quad \cdots\cdots\cdots\cdots\cdots\cdots (1)$$

W_L : Apparent power passing through the capacitor
e_{HE} : Applied high frequency voltage (Effective value)
i : High frequency current
R : High frequency resistance at the electrodes and connecting terminals

The heating due to Joule heat at areas where electrodes and terminals join is given by:

$$W_{r2} = R \cdot i^2$$
$$= R \cdot i \cdot 2\pi f \cdot C \cdot e_{HE}$$
$$= R \cdot 2\pi f \cdot C \cdot W_L \quad \cdots\cdots\cdots\cdots\cdots\cdots (2)$$

Thus, the total calorific value is expressed by:

$$W_r = W_{r1} + W_{r2}$$
$$= DF \cdot W_L + R \cdot 2\pi f \cdot C \cdot W_L$$

The total calorific value W_r is made up of a term in which the value is independent of frequency when W_L is constant, and a second term in which the value is proportional to frequency.

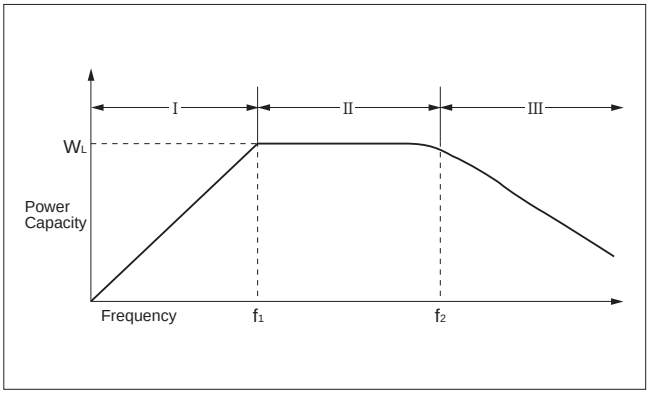
(This is based on the assumption that DF and R remain constant independent of f.)

Thus, the value in the second term is small when the frequency is relatively low; the first term becomes dominant.

As a result, the calorific value becomes proportional to the apparent power W_L which passes through the capacitor independent of frequency.

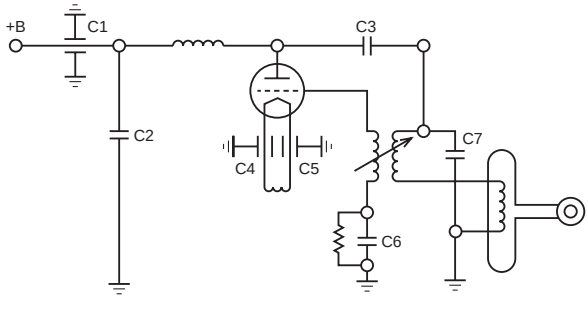
At high frequencies, on the other hand, the second term becomes dominant, and W_r becomes proportional to W_L and frequency.

When W_r is maintained at a constant value, therefore, the power capacity W_L that can be passed through the capacitor remains constant independent of frequency at relatively low frequencies, while at high frequencies, W_L decreases, being inversely proportional to frequency.



Critical frequencies f_1 and f_2 vary with the shape, operating voltage, capacitance, etc. of a capacitor but f_1 ranges from 200kHz to 2MHz and f_2, from 2MHz to 20MHz.

3. The example of a circuit Induction-heating equipment



C1
C3 : DCT
C5
C7 : DCT
C2 : DCT
C4
C6 : DCT

■ Main Uses

Equipment	Use	Recommendation
Induction heating equipment	Hardening, Melting Furnace, Tube welder	**DCT** series
High frequency heating equipment	Welding for PVC, Wood Dryer	**DCT** series, **DCA** series
Medical equipment	Magnetic resonance imaging (MRI)	**DC5** series
Radio communication equipment	Ships, Airplanes	**DC5** series
High frequency power supply	RF plasma generator	**DCT** series, **DCA** series, **DC5** series
	Industrial laser equipment (RF excitation)	**DCT** series

High Frequency Power Ceramic Capacitors

Flange Type/Disc Type **DCT/DCA** Series

■ Features

1. Small size and high capacitance
2. Linear and reversible temperature characteristics
3. Very high "Q" and high insulation resistance from low frequency to high frequency
4. No performance deterioration after extended life–excellent humidity and thermal resistance
5. Low series inductance with excellent frequency performance
6. High power capacity for small capacitor due to low level of heating by dielectric loss when high voltage at high frequency is applied

■ Applications

1. Oscillators, coupling circuit, or bypass capacitors in industrial or medical high frequency appliances such as high frequency heating equipment or ultrasonic instruments
2. Coupling capacitors for transmission line and carrier frequency equipment

■ Marking

1. Type Code
2. Capacitance and Tolerance
3. Rated Voltage (H.F.)
4. Rated Voltage (Vdc)
5. Rated Power Capacity
6. Prod. Lot No.
7. Manufacturer's Identification

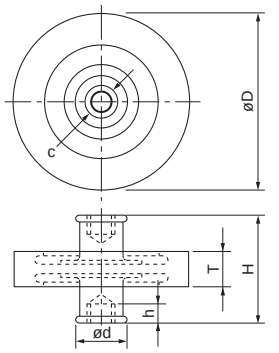
■ Insulation Coating

Capacitor surface is coated with insulation resin except terminals. Temp. coefficient is shown by the following color marking.

Char. SL, UJ: Green
Char. CH: Orange

DCT Series
Shape Code **B2-B4**

Shape Code	Terminal	Dimensions (mm)	
	C	d	h
B2	ISO M4	10	8
B3	ISO M6	12	8
B4	ISO M6	18	8

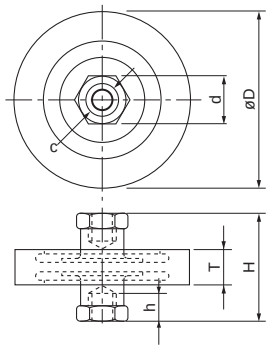


(in mm)

<Fig. 1>

DCT Series
Shape Code **B5-B8**

Shape Code	Terminal	Dimensions (mm)	
	C	d	h
B5	ISO M8	17	15
B6	ISO M8	21	15
B7	ISO M8	21	15
B8	ISO M10	35	20

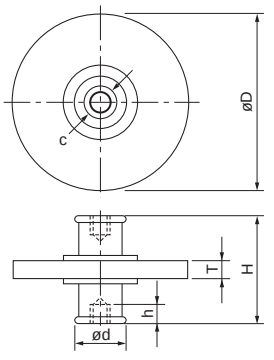


(in mm)

<Fig. 2>

DCA Series

Shape Code	Terminal	Dimensions (mm)	
	C	d	h
A2	ISO M5	10	8
A3	ISO M6	12	8
A4	ISO M6	18	8



(in mm)

<Fig. 3>

DCT Series UJ Characteristics

Part Number	Type Code	Cap. (pF)	Rated Volt.		Test Volt.	Rated Allowable Power (kVA)	Allowable max. Current (A [r.m.s.])	Dimensions (mm)			Fig. No.
			H.F. Peak Value (kV)	DC Rated Volt. (kV)	H.F. Peak Value (kV)			øD±10%	T±2	H±2	
DCT3UB4500KB2B	DCT40	50	12	10	14	6	10	40	15	29	1
DCT3UB4101KB2B	DCT40	100	12	10	14	6	10	40	15	29	
DCT3UJ3201KB2B	DCT40	200	6	5	7	4.5	10	40	11	25	
DCT3UJ3301KB2B	DCT40	300	6	5	7	4.5	10	40	9.5	24	
DCT3UAF101KB3B	DCT60	100	14	12	16	15	15	60	16	27	
DCT3UAF201KB3B	DCT60	200	14	12	16	15	15	60	16	27	
DCT3UB4301KB3B	DCT60	300	12	10	14	7.5	15	60	15	26	
DCT3UJ3501KB3B	DCT60	500	6	5	7	7.5	15	60	12	24	
DCT3UJ3701KB3B	DCT60	700	6	5	7	7.5	15	60	12	24	
DCT3UJ3801KB3B	DCT60	800	6	5	7	7.5	15	60	12	24	
DCT3UH3102KB3B	DCT60	1000	5	4.5	6	7.5	15	60	12	24	
DCT3UAX201KB4B	DCT80	200	16	13	18	30	20	80	17	32	
DCT3UAX301KB4B	DCT80	300	16	13	18	30	20	80	18	33	
DCT3UAF501KB4B	DCT80	500	14	12	16	15	20	80	16	31	
DCT3UAT601KB4B	DCT80	600	9	8	10	15	20	80	14	29	
DCT3UAT701KB4B	DCT80	700	9	8	10	15	20	80	14	29	
DCT3UAR801KB4B	DCT80	800	7	6	8	15	20	80	12	28	
DCT3UAR102KB4B	DCT80	1000	7	6	14	15	20	80	14	28	
DCT3UF4301KB5B	DCT110	300	30	25	33	90	27	110	27	53	2
DCT3UF4401KB5B	DCT110	400	30	25	33	90	27	110	27	53	
DCT3UAX501KB5B	DCT110	500	16	13	18	30	27	110	19	47	
DCT3UB4701KB5B	DCT110	700	12	10	14	30	27	110	18	46	
DCT3UB4801KB5B	DCT110	800	12	10	14	30	27	110	18	46	
DCT3UA4102KB5B	DCT110	1000	10	8	11	30	27	110	17	45	
DCT3UAT152KB5B	DCT110	1500	9	7	11	22	27	110	16	44	
DCT3UAR252KB5B	DCT110	2500	7	6	8	22	27	110	15	43	
DCT3UF4501KB6B	DCT140	500	30	25	33	90	35	140	25	53	
DCT3UF4601KB6B	DCT140	600	30	25	33	90	35	140	25	53	
DCT3UF4801KB6B	DCT140	800	30	25	33	90	35	140	25	53	
DCT3UE4102KB6B	DCT140	1000	25	21	28	90	35	140	22	50	
DCT3UC4152KB6B	DCT140	1500	15	13	17	90	35	140	19	47	
DCT3UE4152KB7B	DCT160	1500	25	21	28	110	40	160	29	49	
DCT3UF4102KB8B	DCT200	1000	30	25	33	300	60	200	33	73	
DCT3UF4152KB8B	DCT200	1500	30	25	33	300	60	200	32	72	

DCT Series CH Characteristics

Part Number	Type Code	Cap. (pF)	Rated Volt.		Test Volt.	Rated Allowable Power (kVA)	Allowable max. Current (A [r.m.s.])	Dimensions (mm)			Fig. No.
			H.F. Peak Value (kV)	DC Rated Volt. (kV)	H.F. Peak Value (kV)			øD±10%	T±2	H±2	
DCT2CAX101KB4B	DCT80	100	16	19	18	30	20	80	17	32	1
DCT2CAX151KB4B	DCT80	150	16	19	18	30	20	80	14	29	
DCT2CAK101KB5B	DCT110	100	22.5	26	25	67.5	27	110	22	46	2
DCT2CAK201KB5B	DCT110	200	22.5	26	25	67.5	27	110	22	46	

DCA Series SL Characteristics

Part Number	Type Code	Cap. (pF)	Rated Volt.		Test Volt.	Rated Allowable Power (kVA)	Allowable max. Current (A [r.m.s.])	Dimensions (mm)			Fig. No.
			H.F. Peak Value (kV)	DC Rated Volt. (kV)	H.F. Peak Value (kV)			øD±10%	T±1	H±2	
DCA1XA3102KA2B	DAT40	1000	1	3.5	2	2	5	40	2.4	23	3

DCA Series UJ Characteristics

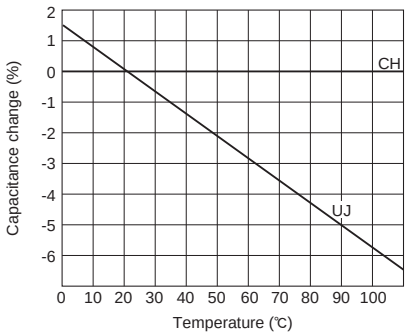
Part Number	Type Code	Cap. (pF)	Rated Volt.		Test Volt.	Rated Allowable Power (KVA)	Allowable max. Current (A [r.m.s.])	Dimensions (mm)			Fig. No.
			H.F. Peak Value (kV)	DC Rated Volt. (kV)	H.F. Peak Value (kV)			øD±10%	T±1	H±2	
DCA3UD3101KA2B	DAT40	100	2	6	3	3	8.5	40	2.8	24	3
DCA3UD3201KA2B	DAT40	200	2	6	3	3	8.5	40	2.8	24	
DCA3UD3301KA2B	DAT40	300	2	3.5	3	2.2	8.5	40	2.8	24	
DCA3UD3401KA2B	DAT40	400	2	3.5	3	2.2	8.5	40	1.4	22	
DCA3UD3501KA2B	DAT40	500	2	3.5	3	2.2	8.5	40	1.4	22	
DCA3UD3102KA3B	DAT60	1000	2	6	3	5	14	60	1.8	23	
DCA3UD3152KA4B	DAT80	1500	2	6	3	7	18	80	2.2	27	

Specifications and Test Methods

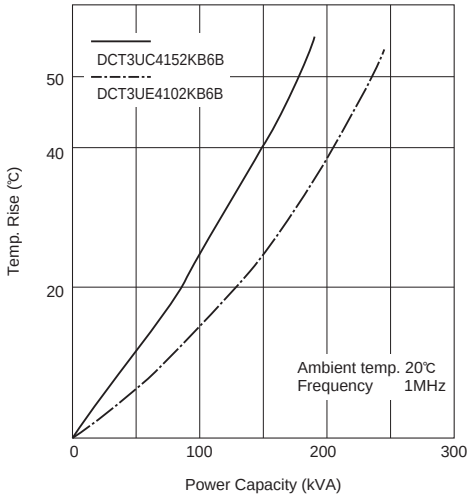
<table>
<tr><th>No.</th><th colspan="2">Item</th><th>Specifications</th><th>Test Method</th></tr>
<tr><td>1</td><td colspan="2">Operating Temperature Range</td><td>-10 to +75˚C</td><td>—</td></tr>
<tr><td>2</td><td colspan="2">Capacitance</td><td>Within the specified tolerance</td><td>The capacitance should be measured at 20°C with 1±0.1MHz and AC5V(r.m.s.) max.</td></tr>
<tr><td>3</td><td colspan="2">Temperature Characteristics</td><td>Temperature coefficient
Char. CH: 0±60ppm/˚C
Char. UJ: -750±120ppm/˚C
Char. SL: +350 to -1000ppm/˚C</td><td>The capacitance measurement should be made at each step specified in table.
Capacitance change from the value of step 3 should not exceed the limit specified.
<table><tr><th>Step</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr><tr><td>Temp. (°C)</td><td>20±2</td><td>-10±3</td><td>20±2</td><td>100±2</td><td>20±2</td></tr></table></td></tr>
<tr><td>4</td><td colspan="2">Quality Factor (Q)</td><td>Char. CH, UJ: 2000 min.
Char. SL: 1000 min.</td><td>The quality factor should be measured at 20°C with 1±0.1MHz and AC5V(r.m.s.) max.</td></tr>
<tr><td>5</td><td colspan="2">Dielectric Strength</td><td>No failure</td><td>The capacitor should not be damaged when the voltage shown in the table below is applied between the terminal for 60±5 sec.
<table><tr><th rowspan="2">DCT</th><th>1500pF max.</th><th>1500pF min.</th><th>2500pF min.</th></tr><tr><td>625kHz</td><td>400kHz</td><td>350kHz</td></tr><tr><th rowspan="2">DCA</th><th colspan="2">1000pF max.</th><th>1000pF min.</th></tr><tr><td colspan="2">1MHz</td><td>350kHz</td></tr></table></td></tr>
<tr><td>6</td><td colspan="2">Insulation Resistance (I.R.)</td><td>10000MΩ min.</td><td>The insulation resistance should be measured with DC1000V within 60±5 sec. of charging.</td></tr>
<tr><td>7</td><td>Strength of Terminal</td><td>Torque Strength</td><td>Capacitor should not be broken.</td><td>The capacitor should not be damaged when the torque shown in the table below is applied to the terminals.
<table><tr><th>Terminal Type</th><th>Torque (N·m)</th></tr><tr><td>ISO-M4</td><td>1.2</td></tr><tr><td>ISO-M5</td><td>1.5</td></tr><tr><td>ISO-M6</td><td>2.45</td></tr><tr><td>ISO-M8</td><td>4.9</td></tr><tr><td>ISO-M10</td><td>9.8</td></tr></table></td></tr>
<tr><td>8</td><td colspan="2">Power Capacity</td><td>30˚C max.</td><td>The rise of temperature at the terminals should be measured at 20°C with 1±0.1MHz and the rated allowable power when the temperature at each section has been stabilized.</td></tr>
</table>

1 Typical Characteristics Data

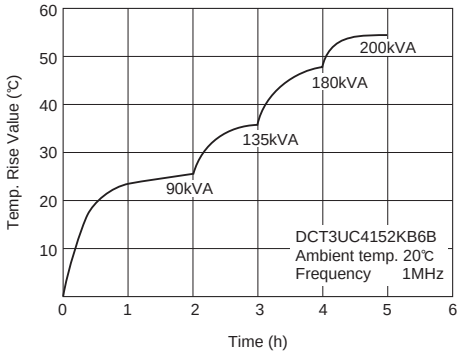
■ Temperature Coefficient



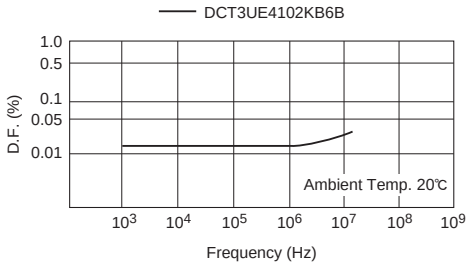
■ Power Capacity vs Temperature Rise



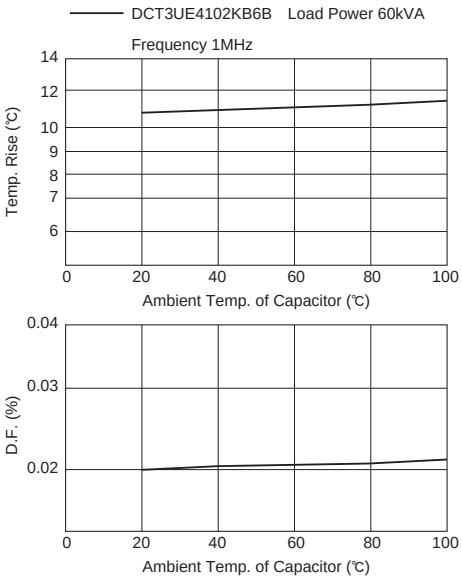
■ Temperature Rise vs Time



■ D.F. vs Frequency



■ Temperature Rise and D.F. vs Ambient Temp. of Capacitor



High Frequency Power Ceramic Capacitors

Small Type **DC5** Series

■ Features

1. Most suitable in mobile equipment for rugged construction, small size and light weight
2. Very resistant to high voltage and power
3. High "Q" and high insulation resistance
4. Low series inductance with excellent frequency performance
5. No performance deterioration after extended life–excellent humidity and thermal resistance

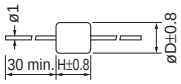
■ Applications

1. Radio communication equipment such as ships and airplanes
2. Small broadcasting equipment
3. High frequency power supply for high frequency heating equipment
4. Various testing and measuring instruments
5. Medical equipment (MRI)

■ Marking

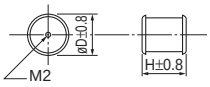
1. Type Code
2. Temperature Coefficient*
3. Capacitance and Tolerance
4. Rated Voltage (Vdc)
5. Prod. Lot No.
6. Manufacturer's Identification

*Temperature Coefficients are expressed as follows:
Char. CH: NP0
Char. UJ: N750
Char. F: X5U



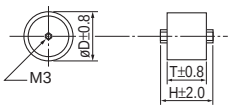
(in mm)

Shape Code **C1, C3** <Fig. 1>



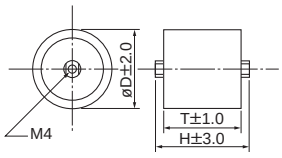
(in mm)

Shape Code **C7** <Fig. 2>



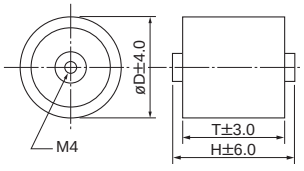
(in mm)

Shape Code **C6, C8** <Fig. 3>



(in mm)

Shape Code **C4** <Fig. 4>



(in mm)

Shape Code **C5** <Fig. 5>

UJ Characteristics

Part Number	Type Code	Cap. (pF)	DC Rated Volt. (kV)	DC Test Volt. (kV)	Rated Allowable Power (kVA)	Allowable max. Current (A [r.m.s.])	Dimensions (mm)			Fig. No.
							øD	T	H	
DC53U3H300KC1B	DC503	30	5	7.5	2.31	0.66	12	—	11	1
DC53U3H400KC1B	DC503	40	5	7.5	3.15	0.89	12	—	11	
DC53U3E500KC1B	DC503	50	2.5	3.75	0.96	0.55	12	—	11	
DC53U3H100KC7B	DC515	10	5	7.5	0.78	0.22	7.5	—	9.7	2
DC53UAD500KC6B	DC510	50	7.5	11.25	8.9	1.7	20	15.5	21	3
DC53UAD750KC6B	DC510	75	7.5	11.25	13.2	2.5	20	15.5	21	
DC53U3H101KC6B	DC510	100	5	7.5	19	3.4	20	15.5	21	
DC53U3H201KC6B	DC510	200	5	7.5	20.1	5.0	20	15.5	21	
DC53U4C101KC4B	DC507	100	15	22.5	35	4.6	30	33	39	4
DC53UAD201KC4B	DC507	200	7.5	11.25	23	5.1	30	33	40	
DC53U4D251KC5B	DC509	250	20	30	40	9.2	48	48	65	5

CH Characteristics

Part Number	Type Code	Cap. (pF)	DC Rated Volt. (kV)	DC Test Volt. (kV)	Rated Allowable Power (kVA)	Allowable max. Current (A [r.m.s.])	Dimensions (mm)			Fig. No.
							øD	T	H	
DC52C3H030DC3B	DC505	3	5	7.5	0.23	0.07	6.3	—	8.5	1
DC52C3H050DC3B	DC505	5	5	7.5	0.38	0.11	6.3	—	8.5	
DC52C3E100DC3B	DC505	10	2.5	3.75	0.19	0.11	6.3	—	8.5	
DC52C3H100KC1B	DC505	10	5	7.5	0.78	0.22	12	—	11	
DC52C3H200KC1B	DC505	20	5	7.5	1.55	0.44	12	—	11	
DC52C3H050DC7B	DC515	5	5	7.5	0.38	0.11	7.5	—	9.7	2
DC52CAD150KC6B	DC510	15	7.5	11.25	4.0	0.61	20	15.5	21	3
DC52CAD250KC6B	DC510	25	7.5	11.25	5.0	0.89	20	15.5	21	
DC52CAD300KC6B	DC510	30	7.5	11.25	5.7	1.0	20	15.5	21	
DC52CAD400KC6B	DC510	40	7.5	11.25	5.6	1.38	20	15.5	21	
DC52CAD500KC6B	DC510	50	7.5	11.25	8.9	1.7	20	15.5	21	
DC52C4C250KC4B	DC507	25	15	22.5	18.5	1.7	30	33	41	4
DC52C4C500KC4B	DC507	50	15	22.5	35	3.3	30	33	38	

F Characteristics

Part Number	Type Code	Cap. (pF)	DC Rated Volt. (kV)	DC Test Volt. (kV)	Rated Allowable Power (kVA)	Allowable max. Current (A [r.m.s.])	Dimensions (mm)			Fig. No.
							øD	T	H	
DC5F33H501MC8B	DC518	500	5	7.5	0.3	1.4	20	15.5	21	3
DC5F33H102MC8B	DC518	1000	5	7.5	0.4	1.1	20	15.5	21	

Specifications and Test Methods

No.	Item	Specifications	Test Method
1	Operating Temperature Range	-10 to +75˚C	—
2	Capacitance	Within the specified tolerance	The capacitance should be measured at 20°C with 1±0.1MHz (Char. F: 1±0.1kHz) and AC5V(r.m.s.) max.
3	Temperature Characteristics	Temperature coefficient Char. CH: 0±60ppm/˚C Char. UJ: -750±120ppm/˚C Char. F: +30%/-80%	The capacitance measurement should be made at each step specified in table. Capacitance change from the value of step 3 should not exceed the limit specified. Step 1: Temp. (°C) 20±2; Step 2: -25±3; Step 3: 20±2; Step 4: 85±2; Step 5: 20±2
4	Quality Factor (Q)	Char. CH, UJ: 400+200C* min. (30pF under) : 1000 min. (30pF min.)	The quality factor and dissipation factor should be measured at 20°C with 1±0.1MHz (Char. F: 1±0.1kHZ) and AC5V(r.m.s.) max.
	Dissipation Factor (D.F.)	Char. F: 5.0% max.	
5	Dielectric Strength	No failure	The capacitor should not be damaged when DC voltage of 150% of the rated voltage is applied between the terminal for 60±5 sec.
6	Insulation Resistance (I.R.)	10000MΩ min.	The insulation resistance should be measured with DC1000V within 60±5 sec. of charging.
7	Strength of Terminal / Torque Strength	Capacitor should not be broken.	The capacitor should not be damaged when the torque shown in the table below is applied to the terminals. ISO-M2: 0.39 ISO-M3: 0.49 ISO-M4: 1.2
8	Power Capacity	30˚C max.	The rise of temperature at the terminals should be measured at 20°C with 1±0.1MHz and the rated allowable power when the temperature at each section has been stabilized.

* "C" expresses nominal capacitance value (pF)

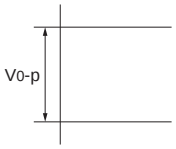
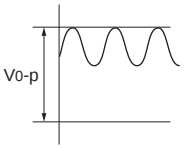
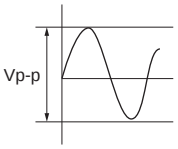
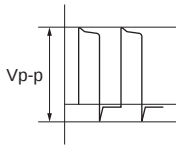
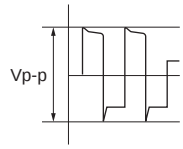
⚠Caution/Notice

■ ⚠Caution (Rating)

1. Operating Voltage

When DC-rated capacitors are to be used in AC or ripple current circuits, be sure to maintain the Vp-p value of the applied voltage or the Vo-p which contains DC bias within the rated voltage range.

When the voltage is applied to the circuit, starting or 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.

Voltage	DC Voltage	DC+AC Voltage	AC Voltage	Pulse Voltage (1)	Pulse Voltage (2)
Positional Measurement					

2. Operating Temperature and Self-generated Heat

Keep the surface temperature of a capacitor below the upper limit of its rated operating temperature range. Be sure to take into account the heat generated by the capacitor itself. When the capacitor is used in a high frequency current, it may self-generate heat due to dielectric loss. The applied voltage load should be such that the capacitor's self-generated heat is within 10°C (in case of temperature characteristic F and within 20°C) at an atmosphere temperature of 25°C. Excessive heat may lead to deterioration of the capacitor's characteristics and reliability. (Never attempt to perform measurement with the cooling fan running. Otherwise, accurate measurement cannot be ensured.)

■ ⚠Caution (Storage and Operation Condition)

Operating and storage environment

The insulating coating of capacitors does not form a perfect seal; therefore, do not use or store capacitors in a corrosive atmosphere, especially where chloride gas, sulfide gas, acid, alkali, salt or the like are present. And avoid exposure to moisture.

Avoid a dusty place. Otherwise, surface corona discharge and flashover may occur.

Store the capacitors where the temperature and relative humidity do not exceed -10 to 40 degrees centigrade and 15 to 85%. Use capacitors within 6 months.

⚠Caution/Notice

■ ⚠Caution (Soldering and Mounting)

1. Installation (Except for DC5 Series/Shape code: C1, C3)
   Installation torque should not exceed the torque strength values in "Specifications and Test Methods".
   Do not use a screw with a thread depth greater than specified.
   Avoid installation in which any bending torque is applied to the capacitor terminal.
   Do not fix the product body with only one terminal. (Avoid cantilever mounting.) Do not rework or solder the terminals.
2. Soldering (DC5 Series/Shape code: C1, C3)
   When soldering this product to a PCB/PWB, do not exceed the solder heat resistance specification of the capacitor. Subjecting this product to excessive heating could melt the internal junction solder and may result in thermal shocks that can crack the ceramic element.
   When soldering capacitor with a soldering iron, it should be performed in following conditions.
   Soldering method: Soldering iron
   Soldering temperature: 270°C max.
   Soldering time: 3 sec. max.
   *Solder the lead terminals at 3mm or longer distance from their roots.

■ ⚠Caution (Handling)

Vibration and impact
Since this product is made of ceramics, applying impact (drop impact, etc.) to the product results in breakage or flaws of elements. Do not transport the product with the product being mounted to the set.
Otherwise, the terminal strength may be deteriorated due to impact or vibration.

FAILURE TO FOLLOW THE ABOVE CAUTIONS MAY RESULT, WORST CASE, IN A SHORT CIRCUIT AND CAUSE FUMING OR PARTIAL DISPERSION WHEN THE PRODUCT IS USED.

■ Notice (Rating)

Capacitance change of capacitor

1. Class 1 capacitors
   Capacitance might change a little depending on the surrounding temperature or an applied voltage.
   Please contact us if you intend to use this product in a strict time constant circuit.
2. Class 2 and 3 capacitors
   Class 2 and 3 capacitors with temperature characteristics B, E and F have an aging characteristic, whereby the capacitor continually decreases its capacitance slightly if the capacitor is left on for a long time. Moreover, capacitance might change greatly depending on the surrounding temperature or an applied voltage. So, it is not likely to be suitable for use in a time constant circuit.
   Please contact us if you need detailed information.

⚠Note:

1. Export Control
   〈For customers outside Japan〉
   Murata products should not be used or sold for use in the development, production, stockpiling or utilization of any conventional weapons or mass-destructive weapons (nuclear weapons, chemical or biological weapons, or missiles), or any other weapons.
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   For products which are controlled items subject to the “Foreign Exchange and Foreign Trade Law” of Japan, the export license specified by the law is required for export.
2. Please contact our sales representatives or product engineers before using the products in this catalog for the applications listed below, which require especially high reliability for the prevention of defects which might directly damage to a third party's life, body or property, or when one of our products is intended for use in applications other than those specified in this catalog.
   ① Aircraft equipment ② Aerospace equipment
   ③ Undersea equipment ④ Power plant equipment
   ⑤ Medical equipment ⑥ Transportation equipment (vehicles, trains, ships, etc.)
   ⑦ Traffic signal equipment ⑧ Disaster prevention / crime prevention equipment
   ⑨ Data-processing equipment ⑩ Application of similar complexity and/or reliability requirements to the applications listed in the above
3. Product specifications in this catalog are as of May 2005. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before ordering. If there are any questions, please contact our sales representatives or product engineers.
4. Please read rating and ⚠CAUTION (for storage, operating, rating, soldering, mounting and handling) in this catalog to prevent smoking and/or burning, etc.
5. This catalog has only typical specifications because there is no space for detailed specifications. Therefore, please approve our product specifications or transact the approval sheet for product specifications before ordering.
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7. No ozone depleting substances (ODS) under the Montreal Protocol are used in our manufacturing process.

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