REFERENCE SPECIFICATION

High Voltage Ceramic Capacitor
DHR4E4A102M1FB

Issued Date: April 16, 2008

Product specifications in this drawing are subject to change or our products described in this drawing may be discontinued without advance notice.
The parts numbers and specifications listed in this drawing are for information only. You are requested to transact the “Approval Sheet Product Specification”, before your ordering.

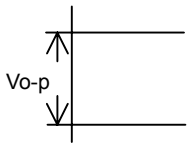
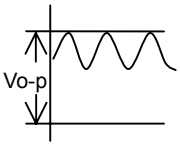
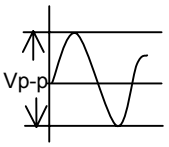
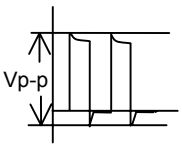
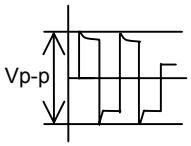
PRODUCT ENGINEERING SECTION
CAPACITOR GROUP

IZUMO MURATA MANUFACTURING. Co.,LTD

⚠ CAUTION

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 started to apply to the circuit or it is stopped applying, the irregular voltage may be generated for a transit period because of resonance or switching. Be sure to use a capacitor within rated voltage containing these irregular voltage.

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, pulse current or the like, it may have the self-generated heat due to dielectric-loss. Applied voltage should be the load such as self-generated heat is within 10 °C on the condition of atmosphere temperature 25 °C. When measuring, use a thermocouple of small thermal capacity-K of ϕ0.1mm and be in the condition where capacitor is not affected by radiant heat of other components and wind of surroundings.

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.)

3. 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. The capacitor is designed to be used in the insulating media, such as epoxy resin, silicone oil, etc.. There must be 3mm or more insulating media for each direction of the capacitor. Before cleaning, bonding, or molding this product, verify that these processes do not affect product quality by testing the performance of a cleaned, bonded or molded product in the intended equipment. Store the capacitors where the temperature and relative humidity do not exceed -10 to 40 °C and 15 to 85 %. Use capacitors within 6 months after delivered..

4. VIBRATION AND IMPACT

Do not expose a capacitor or its leads to excessive shock or vibration during use.

5. SOLDERING

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.

Temperature of iron-tip : 400 °C max.
Soldering iron wattage : 50W max.
Soldering time : 3.5s max.

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.

6. Limitation of Applications

Please contact us before using our products for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property.

①Aircraft equipment ②Aerospace equipment ③Undersea equipment
④Power plant control equipment ⑤Medical equipment
⑥Transportation equipment(vehicles, trains, ships, etc.) ⑦Traffic signal equipment
⑧Disaster prevention / crime prevention equipment ⑨Data-processing equipment
⑩Application of similar complexity and/or reliability requirements to the applications listed in the above.

NOTICE

Cleaning

To perform ultrasonic cleaning, observe the following conditions.
Rinse bath capacity : Output of 20 watts per liter or less.
Rinsing time : 5min maximum.
Do not vibrate the PCB/PWB directly.
Excessive ultrasonic cleaning may lead to fatigue destruction of the lead wires.

Capacitance change of capacitor

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

⚠ NOTE

1. Please make sure that your product has been evaluated in view of your specifications with our product being mounted to your product.
2. You are requested not to use our product deviating from the agreed specifications.
3. We consider it not appropriate to include any terms and conditions with regard to the business transaction in the product specifications, drawings or other technical documents. Therefore, if your technical documents as above include such terms and conditions such as warranty clause, product liability clause, or intellectual property infringement liability clause, they will be deemed to be invalid.

1. Application

This specification is applied to ceramic capacitor DHR series used for in electric equipment.
DHR series is high voltage disc ceramic capacitor

2. Rating

2.1 Operating temperature

-25°C to +85°C

2.2 Part unmber

DHR	4E	4A	102	M	1F	B	
Series	Temperature characteristic	Rated voltage	Capacitance	Capacitance tolerance	Lead code	Packing style code	Individual specification

• Temperature characteristic

Code	Temperature characteristic
4E	ZM

Please confirm detailed specification on [5. Specification and test methods].

• Rated voltage

Code	Rated voltage
4A	DC10kV

• Capacitance

The first two digits denote significant figures ; the last digit denotes the multiplier of 10 in pF.
ex.) In case of 102.

$$10 \times 10^2 = 1000\text{pF}$$

• Capacitance tolerance

Please refer to [4. Part unmber list].

• Lead code

Code	Lead style
1F	Straight long

Please refer to [4. Part unmber list].

Solder coated copper wire is applied for termination.

• Packing code

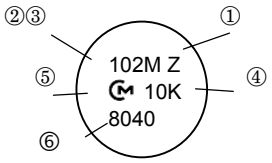
Code	Packing type
B	Bulk type

• Individual specification

In case part number cannot be identified without ‘individual specification‘, it is added at the end of part number.

3. Marking

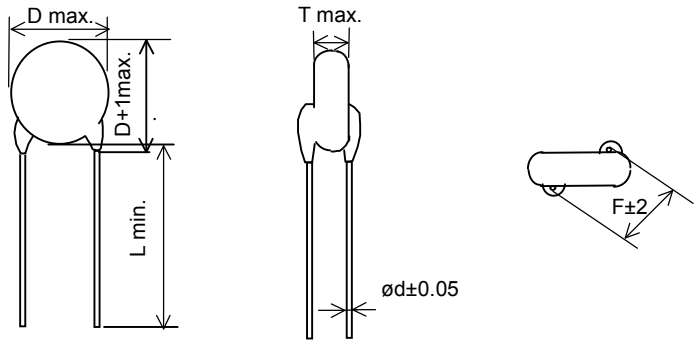
①Temperature Characteristic: Marked with Z
②Capacitance : marked with 3 figures.
③Cap. tolerance : marked with code.
④Rated Voltage: marked with code.
⑤Manufacturer's identification : marked with code.
(Omitted for nominal body dia. ø14max.)
⑥Manufactuered Date : marked with code.
(Omitted for nominal body dia. ø14max.)



ex. 8 04 0
1) 2) 3)

1)Last numeral in year
2)number in the month
3)Fix No.

4.Part number List

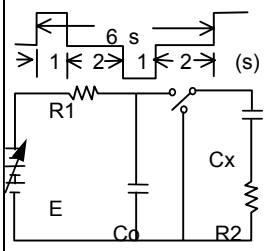


Unit:mm

Temp. Char.	Cap. (pF)	Cap. tol. (%)	Customer part number	Murata part number	DC Rated. volt. (kV)	Dimensions (mm)					Lead code	Pack qty.
						D	T	F	L	d		
ZM	1000	±20		DHR4E4A102M1FB	10	19.0	8.5	12.7	25.0	0.8	1F	50

5.TEST

5-1VISUAL EXAMINATION CHECK OF DIMENSIONS

<table>
<tr><th>No.</th><th colspan="2">ITEM</th><th>SPECIFICATION</th><th>TESTING METHOD</th></tr>
<tr><td>1</td><td colspan="2">Appearance dimensions</td><td>See 3,4.</td><td>Shall be visually examined or Venire Calipers.</td></tr>
<tr><td>2</td><td colspan="2">Marking</td><td>To be easily legible.</td><td>Shall be visually examined.</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Dielectric Strength</td><td>Between Lead wires</td><td rowspan="2">No failure</td><td>The capacitors shall not be damage when DC voltage of 150% of the rated voltage are applied between the lead wires for 60 s in insulate liquid or gas.
(Charge/discharge current: 50mA max.)</td></tr>
<tr><td>Body insulation</td><td>The capacitors is placed in the container with metal balls of diameter 1mm so that each lead wires, Short-circuited, is kept approximately 2mm off the balls as shown in the figure, and DC voltage of 3kV is applied for 10 s between capacitor lead wires and small metals.
(Charge/discharge current: 50mA max.)</td></tr>
<tr><td>4</td><td>Insulation Resistance (I.R.)</td><td>Between Lead wires</td><td>10,000M Ωmin.</td><td>The insulation resistance shall be measured with DC 1kV within 60±5 s of charging.</td></tr>
<tr><td>5</td><td colspan="2">Capacitance</td><td>Within the specified tolerance.</td><td>The capacitance shall be measured at 20°C with 1±0.2kHz and AC5V(r.m.s.) max..</td></tr>
<tr><td>6</td><td colspan="2">Dissipation Factor (D.F.)</td><td>1.0% max.</td><td>Same condition as capacitance.</td></tr>
<tr><td>7</td><td colspan="2">Temperature Characteristic</td><td>-4700±1000ppm/°C</td><td>The capacitance measurement shall be made at each step specified in table.
Capacitance change from the value of step 3 shall not exceed the limit specified.
<table>
<tr><th>Step
Temp.</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>ZM</td><td>-</td><td>-</td><td>20±2°C</td><td>85±2°C</td><td>20±2°C</td></tr>
</table></td></tr>
<tr><td rowspan="5">8</td><td rowspan="5">Charge Discharge Test</td><td>Appearance</td><td>No marked defect.</td><td rowspan="5">Charge discharge test shall be measured in the following test circuit and cycle.
Applied voltage: rated voltage
Cycle numbers: 20,000 cycles
Post-treatment: Capacitor shall be stored for 4 h at room condition.
 

E:Direct-current Voltage source
Co:Suppled energy for Cx. (Co≠10Cx)
Cx: Specimen
R1:Circuit protective resistor (300kΩ)
R2:Current limiting Resistor (E/10Ω)</td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>D.F.</td><td>1.5% max.</td></tr>
<tr><td>I.R.</td><td>5,000MΩ min.</td></tr>
<tr><td>Dielectric Strength (Between lead wires)</td><td>No failure</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Strength of Lead</td><td>Pull</td><td rowspan="2">Lead wire shall not cut off.
Capacitor shall not be broken.</td><td>Fix the body of capacitor, apply a tensile weight gradually to each lead wire in the radial direction of capacitor up to 10N, and keep it for 10±1 s.</td></tr>
<tr><td>Bending</td><td>Each lead wire shall be subjected to 5N weight and then a 90° to bend, at the point of egress, in one direction, return to original position, and then a 90° bend in the opposite direction at the rate of one bend in 2 to 3 s.</td></tr>
</table>

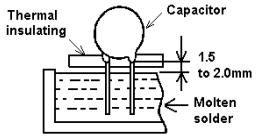
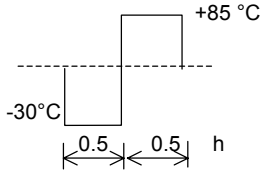
Note) Tests for Dielectric strength ,Charging/Discharging test, Humidity , Life and Temperature cycling shall be performed with specimens having molded resin (MR1023C:made by Murata) extending over 3mm on all the surface.

Room condition

Temperature:15~35°C

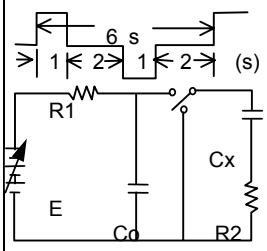
Humidity:45~75%

Atmospheric pressure:86~106kPa

No.	ITEM		SPECIFICATION	TESTING METHOD
10	Solderability of Leads		Lead wire shall be soldered with uniformly coated on the axial direction over 3/4 of the circumferential direction.	The lead wire shall be dipped into a 25% methanol solution of rosin and then into molten solder of 235±5°C for 2±0.5 s. In both cases the depth of dipping is up to about 1.5 to 2.0mm from the root of lead wires. Temp. of solder : Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C H63 Eutectic Solder 235±5°C
11	Soldering effect (Non-preheat)	Appearance	No marked defect.	The lead wires shall be immersed into the melted solder of 350±10°C up to about 1.5 to 2.0mm from the main body for 3.5±0.5 s. Post-treatment: Capacitor shall be stored for 24±2 h at room condition.
		Capacitance Change	Within±10%	
		Dielectric Strength (Between lead wires)	No failure	
12	Soldering effect (On-preheat)	Appearance	No marked defect.	First the capacitor should be stored at 120+0/-5°C for 60+0/-5 s. Then, as in figure, the lead wires should be immersed solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 s.  Post-treatment : Capacitor should be stored for 1 to 2 h at room condition.
		Capacitance Change	Within±10%	
		Dielectric Strength (Between lead wires)	Per item 3.	
	Humidity (under steady state)	Appearance	No marked defect.	Set the capacitor for 240±8 h at 40±2°C in 90 to 95% humidity. Post-treatment: Capacitor shall be stored for 1 to 2 h at room condition. (Charge/discharge current: 50mA max.)
		Capacitance Change	Within±10%	
		D.F.	1.5% max.	
		I.R.	5000MΩ min.	
		Dielectric Strength (Between lead wires)	No failure	
13	Life (high temperature load)	Appearance	No marked defect.	Apply a DC voltage of 125% of the rated voltage for 1000+48/-0 h in silicon oil at 85±2°C. Post-treatment: Capacitor shall be stored for 24±2 h at room condition. (Charge/discharge current:50mA max.)
		Capacitance Change	Within±10%	
		D.F.	1.5% max.	
		I.R.	5000MΩ min.	
		Dielectric Strength (Between lead wires)	No failure	
14	Temperature Cycling	Appearance	No marked defect.	 Temperature cycling shall be measured in the following test. Cycle numbers: 5 cycles Post-treatment: Capacitor shall be stored for 4 h at room condition.
		Capacitance Change	Within±10%	
		D.F.	1.5% max.	
		I.R.	5000MΩ min.	
		Dielectric Strength (Between lead wires)	No failure	

5.TEST

5-1VISUAL EXAMINATION CHECK OF DIMENSIONS

<table>
<tr><th>No.</th><th colspan="2">ITEM</th><th>SPECIFICATION</th><th>TESTING METHOD</th></tr>
<tr><td>1</td><td colspan="2">Appearance dimensions</td><td>See 3,4.</td><td>Shall be visually examined or Venire Calipers.</td></tr>
<tr><td>2</td><td colspan="2">Marking</td><td>To be easily legible.</td><td>Shall be visually examined.</td></tr>
<tr><td rowspan="2">3</td><td rowspan="2">Dielectric Strength</td><td>Between Lead wires</td><td rowspan="2">No failure</td><td>The capacitors shall not be damage when DC voltage of 150% of the rated voltage are applied between the lead wires for 60 s in insulate liquid or gas.
(Charge/discharge current: 50mA max.)</td></tr>
<tr><td>Body insulation</td><td>The capacitors is placed in the container with metal balls of diameter 1mm so that each lead wires, Short-circuited, is kept approximately 2mm off the balls as shown in the figure, and DC voltage of 3kV is applied for 10 s between capacitor lead wires and small metals.
(Charge/discharge current: 50mA max.)</td></tr>
<tr><td>4</td><td>Insulation Resistance (I.R.)</td><td>Between Lead wires</td><td>10,000M Ωmin.</td><td>The insulation resistance shall be measured with DC 1kV within 60±5 s of charging.</td></tr>
<tr><td>5</td><td colspan="2">Capacitance</td><td>Within the specified tolerance.</td><td>The capacitance shall be measured at 20°C with 1±0.2kHz and AC5V(r.m.s.) max..</td></tr>
<tr><td>6</td><td colspan="2">Dissipation Factor (D.F.)</td><td>1.0% max.</td><td>Same condition as capacitance.</td></tr>
<tr><td>7</td><td colspan="2">Temperature Characteristic</td><td>-4700±1000ppm/°C</td><td>The capacitance measurement shall be made at each step specified in table.
Capacitance change from the value of step 3 shall not exceed the limit specified.
<table>
<tr><th>Step
Temp.</th><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th></tr>
<tr><td>ZM</td><td>-</td><td>-</td><td>20±2°C</td><td>85±2°C</td><td>20±2°C</td></tr>
</table></td></tr>
<tr><td rowspan="5">8</td><td rowspan="5">Charge Discharge Test</td><td>Appearance</td><td>No marked defect.</td><td rowspan="5">Charge discharge test shall be measured in the following test circuit and cycle.
Applied voltage: rated voltage
Cycle numbers: 20,000 cycles
Post-treatment: Capacitor shall be stored for 4 h at room condition.
 

E:Direct-current Voltage source
Co:Suppled energy for Cx. (Co≠10Cx)
Cx: Specimen
R1:Circuit protective resistor (300kΩ)
R2:Current limiting Resistor (E/10Ω)</td></tr>
<tr><td>Capacitance Change</td><td>Within ±10%</td></tr>
<tr><td>D.F.</td><td>1.5% max.</td></tr>
<tr><td>I.R.</td><td>5,000MΩ min.</td></tr>
<tr><td>Dielectric Strength (Between lead wires)</td><td>No failure</td></tr>
<tr><td rowspan="2">9</td><td rowspan="2">Strength of Lead</td><td>Pull</td><td rowspan="2">Lead wire shall not cut off.
Capacitor shall not be broken.</td><td>Fix the body of capacitor, apply a tensile weight gradually to each lead wire in the radial direction of capacitor up to 10N, and keep it for 10±1 s.</td></tr>
<tr><td>Bending</td><td>Each lead wire shall be subjected to 5N weight and then a 90° to bend, at the point of egress, in one direction, return to original position, and then a 90° bend in the opposite direction at the rate of one bend in 2 to 3 s.</td></tr>
</table>

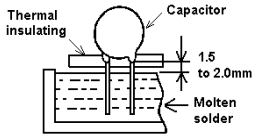
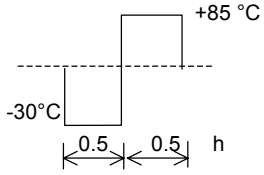
Note) Tests for Dielectric strength ,Charging/Discharging test, Humidity , Life and Temperature cycling shall be performed with specimens having molded resin (MR1023C:made by Murata) extending over 3mm on all the surface.

Room condition

Temperature:15~35°C

Humidity:45~75%

Atmospheric pressure:86~106kPa

No.	ITEM		SPECIFICATION	TESTING METHOD
10	Solderability of Leads		Lead wire shall be soldered with uniformly coated on the axial direction over 3/4 of the circumferential direction.	The lead wire shall be dipped into a 25% methanol solution of rosin and then into molten solder of 235±5°C for 2±0.5 s. In both cases the depth of dipping is up to about 1.5 to 2.0mm from the root of lead wires. Temp. of solder : Lead Free Solder (Sn-3Ag-0.5Cu) 245±5°C H63 Eutectic Solder 235±5°C
11	Soldering effect (Non-preheat)	Appearance	No marked defect.	The lead wires shall be immersed into the melted solder of 350±10°C up to about 1.5 to 2.0mm from the main body for 3.5±0.5 s. Post-treatment: Capacitor shall be stored for 24±2 h at room condition.
		Capacitance Change	Within±10%	
		Dielectric Strength (Between lead wires)	No failure	
12	Soldering effect (On-preheat)	Appearance	No marked defect.	First the capacitor should be stored at 120+0/-5°C for 60+0/-5 s. Then, as in figure, the lead wires should be immersed solder of 260+0/-5°C up to 1.5 to 2.0mm from the root of terminal for 7.5+0/-1 s.  Post-treatment : Capacitor should be stored for 1 to 2 h at room condition.
		Capacitance Change	Within±10%	
		Dielectric Strength (Between lead wires)	Per item 3.	
	Humidity (under steady state)	Appearance	No marked defect.	Set the capacitor for 240±8 h at 40±2°C in 90 to 95% humidity. Post-treatment: Capacitor shall be stored for 1 to 2 h at room condition. (Charge/discharge current: 50mA max.)
		Capacitance Change	Within±10%	
		D.F.	1.5% max.	
		I.R.	5000MΩ min.	
		Dielectric Strength (Between lead wires)	No failure	
13	Life (high temperature load)	Appearance	No marked defect.	Apply a DC voltage of 125% of the rated voltage for 1000+48/-0 h in silicon oil at 85±2°C. Post-treatment: Capacitor shall be stored for 24±2 h at room condition. (Charge/discharge current:50mA max.)
		Capacitance Change	Within±10%	
		D.F.	1.5% max.	
		I.R.	5000MΩ min.	
		Dielectric Strength (Between lead wires)	No failure	
14	Temperature Cycling	Appearance	No marked defect.	 Temperature cycling shall be measured in the following test. Cycle numbers: 5 cycles Post-treatment: Capacitor shall be stored for 4 h at room condition.
		Capacitance Change	Within±10%	
		D.F.	1.5% max.	
		I.R.	5000MΩ min.	
		Dielectric Strength (Between lead wires)	No failure	

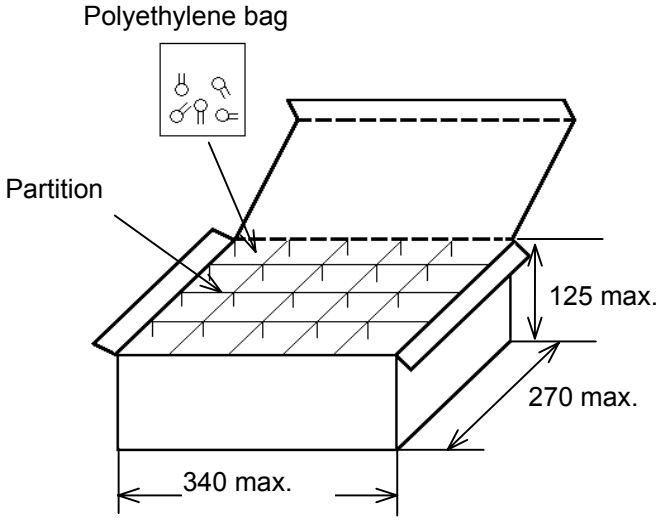
6. Packing Specification

Packaging Styles : Bulk type

(Packing style code : B)

The number of packing = Packing quantity (*1) × n (*2)

The size of packing case and packing way



*1 : Please refer to [Part number list].

*2 : Standard n = 20 (bag)

Note)

The outer package and the number of outer packing be changed by the order getting amount.

Unit : mm