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EIA STANDARD

Ceramic Dielectric Capacitors

Classes 1, 2 and 3

RS-198-B

(Revision of RS-108-A)

October 1971

Engineering Department

ELECTRONIC INDUSTRIES ASSOCIATION

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CERAMIC DIELECTRIC CAPACITORS

CLASSES 1, 2 and 3

(From EIA Standard RC-198-A and Standards Proposal No.1061, formulated under the cognizance of EIA Working Group P-2.1 on Ceramic Capacitors.)

FOREWORD

This standard is a revision and up-dating of RS-198-A covering ceramic dielectric capacitors, to provide information and rating data in accordance with the current state of the art, for several mechanical styles and three major classifications.

INDEX

1. CERAMIC DIELECTRIC CAPACITORS, CLASS 1

1.1 Scope

Components of this classification are temperature compensating ceramic dielectric, fixed capacitors of a type suited for resonant circuit application or other applications where high Q and stability of capacitance characteristics are required.

1.2 Classification

1.2.1 Type Designation

The type designation shall be in the following form, and as defined in Table 1 for Temperature Compensating and General Purpose capacitors:

CCXXXX	U2J	470	G	501
↓	↓	↓	↓	↓
Style	Characteristic	Capacitance	Tol.	Voltage

1.2.2 Style

The style is identified by the two letter symbol "CC" followed by a two, three or four digit number; the letters identify the item as an EIA RS-198 part and the number identifies the shape and dimensions of the capacitors (see individual specification sheets).

1.2.3 Characteristic

The characteristic is identified by a letter-digit-letter symbol in accordance with Table I. The first letter identifies the nominal temperature coefficient, the digit identifies the multiplier and the final letter identifies the tolerance of the temperature coefficient. The temperature coefficient is expressed in parts per million per °C(ppm/°C).

1.2.4 Capacitance and Tolerance

The capacitance and tolerance are identified by 3 digits and a letter symbol in accordance with Table I. The first and second digits identify the first and second significant figures of the capacitance, the third digit identifies the multiplier and the letter identifies the capacitance tolerance.

1.2.4.1 Preferred Number System

Nominal capacitance and tolerances shall be chosen from the Preferred Number system by the single decade values:

5%	10%	20%	5%	10%	20%	5%	10%	20%
10	10	10	22	22	22	47	47	47
11			24			51		
12	12		27	27		56	56	
13			30			62		
15	15	15	33	33	33	68	68	68
16			36			75		
18	18		39	39		82	82	
20			43			91		

1.2.5 Voltage

The voltage is identified by three digits in accordance with Table I. The first and second digits identify the first and second significant figures of the voltage and the third digit identifies the multiplier.

1.2.6 Marking

The capacitors may be marked either by typographical marking or by code, at the option of the manufacturer.

1.2.6.1 Typographical Marking

To the extent that size permits each capacitor shall show:

a) Capacitance in pF or µF and tolerance in percent or by letter designation per Table I. Through 999 will be identified in pF, above 999 in µF.

or

Type Designation in accordance with specification sheet and Table I.

TABLE I

Values shown are standard.

CC XXXX U 2 J 4 7 0 G 50 1

Style Designation - See 1.2.2.

CHARACTERISTIC

Significant Figure of Temp. Coeff. of Capacitance (ppm/°C)	Letter Symbol	Multiplier to Apply to Significant Figure of Temp. Coeff.	Numerical Symbol	Tolerance of Temp. Coeff. (See Note D) (ppm/°C)	Letter Symbol	1st 2nd Significant Figure of Capacitance (pF)	Multiplier Note E	Numerical Symbol	Tolerance of Capacitance			Voltage Rating		
									Nominal 10 pF or Less	Letter Symbol	Nominal Over 10 pF	1st & 2nd Significant Fig.	Multi-plier	Symbol
0.0	C	-1	0	±30	G		1	0	±0.1 pF	B			1	0
1.0	M	-10	1	±60	H		10	1	±0.25pF	C			10	1
1.5	P	-100	2	±120	J		100	2	±0.5 pF	D			100	2
2.2	R	-1000	3	±250	K		1000	3	±1.0 pF	F	±1%		1000	3
3.3	S	-100000	4	±500(Note A)	L		10000	4	±2.0 pF	G	±2%			
4.7	T	+1	5	±1000(Note B)	M		100000	5		H	±3%			
7.5	U	+10	6	±2500(Note C)	N					J	±5%			
		+100	7							K	±10%			
		+1000	8				0.01	8		M	±20%			
		+100000	9				0.1	9						

Note A: Use with Characteristic symbol S2 to indicate General Purpose capacitors with any nominal temp. coeff. between +100 and -750 parts per million per degree C., coefficient used to be at option of capacitor manufacturer.

Note B: Use with Characteristic symbol U2 to indicate General Purpose capacitors with any nominal temp. coeff. between +150 and -1500 parts per million per degree C. coefficient used to be at option of capacitor manufacturer.

Note C: Use with Characteristic symbol S3 to indicate General Purpose capacitors having any nominal temp. coeff. between -1000 and -5200 parts per million per degree C. coefficient used to be at option of capacitor manufacturer.

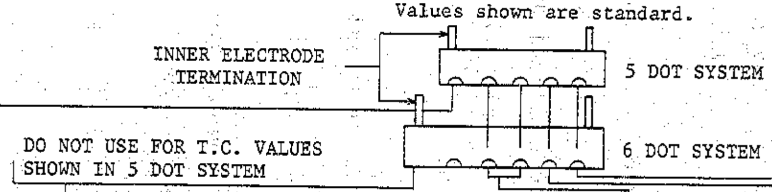
Note D: These symmetrical tolerances apply to 2 point measurement of temperature coefficient one at 25°C and one at 85°C. For tolerance including curvature see paragraphs 1.4 and 1.4.1.

Note E: Use lowest decimal multiplier to avoid alternate coding; for example, 2.0pF should be 209, NOT 020.

TYEP DESIGNATION CODE (Color Marking)

TABLE II

Values shown are standard.



Temperature Coefficient of Capacitance (5 Dot System)	Significant Figure of Temperature Coefficient of Capacitance (6 Dot System)	Multiplier to Apply to Significant Figure of Temperature Co-efficient (6 Dot System)	Color	1st and 2nd Significant Figure of Capacitance	Decimal Multiplier of Capacitance	Tolerance of Capacitance: Nominal 10 pF or Less	Tolerance of Capacitance: Nominal Over 10 pF
0ppm/°C	0.0	- 1	Black	0	1 (Use lowest possible numerical multiplier)	± 2.0 pF	±20%
-33ppm/°C	-	-10	Brown	1	10	± 0.1 pF	± 1%
-75ppm/°C	1.0	-100	Red	2	100		± 2%
-150ppm/°C	1.5	-1000	Orange	3	1000		± 3%
-220ppm/°C	2.2	-10000	Yellow	4	10000		
-330ppm/°C	3.3	+ 1	Green	5		± 0.5 pF	± 5%
-470ppm/°C	4.7	+10	Blue	6			
-750ppm/°C	7.5	+100	Violet	7			
General Purpose Note A	General Purpose Note C	+1000	Gray	8	0.01	± 0.25pF	
General Purpose Note B		+10000	White	9	0.1	± 1.0 pF	±10%

Note A: This is a General Purpose capacitor having any nominal temperature coefficient between +150 and -1500 parts per million per degree Centigrade, coefficient used to be at option of capacitor manufacturer.

Note B: This is a General Purpose capacitor having any nominal temperature coefficient between +100 and -750 parts per million per degree Centigrade, coefficient used to be at option of capacitor manufacturer.

Note C: This is a General Purpose capacitor having any nominal temperature coefficient between -1000 and -5200 parts per million per degree Centigrade, coefficient used to be at option of capacitor manufacturer. Use with multiplier color of black.

b) Temperature Coefficient in parts per million per degree Centigrade or letter designation in accordance with Table I.

c) Manufacturer's name or symbol, or EIA Code number.

d) Indicator of inner electrode terminal (tubular styles only), comprising an easily discernible dot or depression.

or

Inner-electrode terminal shall be located to the left of marking parallel to body of capacitor, or above circumferential marking.

1.2.6.2 Color Marking

The color marking of fixed Ceramic Dielectric Capacitors Class I shall be the 5 dot system for temperature characteristics of NPO thru N750 and General Purpose as shown in Table II, Column 1. The 6 dot system in Table II shall be used for all other temperature characteristics.

Table II illustrates application to tubular style. For disc or plate styles, color code shall read from left to right as observed with lead wires downward, and, of course, no inner electrode identification is applicable. Inner electrode terminal on tubular styles shall be indicated by an easily discernible dot or depression.

or

By locating end color adjacent to inner electrode terminal as shown in Table II.

1.3 Standard Temperature Coefficients and associated tolerances are as indicated in Table III below, in terms of Temperature Characteristic symbols in Table I.

TABLE III

Temperature Coefficient (1st and 2nd Symbols of "Characteristic")

Capacity pF	P7 +150	M7 +100	56 +33	C0 0	S1 -33	U1 -75	P2 -150	R2 -220	S2 -330	T2 -470	U2 -750	P3 -1500	R3 -2200	S3 -3300	T3 -4700
0.5 to 2.0	K	K	K	K	K	K	K	K	KL	K	KM	K	L	LN	M
3	JK	JK	JK	JK	JK	JK	JK	JK	JKL	JK	JKM	K	L	LN	M
4 to 9	HJK	HJK	HJK	HJK	HJK	HJK	HJK	HJK	HJKL	JK	JKM	K	L	LN	M
10 to 91	GHJK	GHJK	GHJK	GHJK	GHJK	GHJK	GHJK	GHJK	HJKL	HJK	HJKM	K	L	LN	M
100 and above	GHJK	GHJK	GHJK	GHJK	GHJK	GHJK	GHJK	GHJK	HJKL	HJK	HJKM	K	L	LN	M

1.4 Calculation of Temperature Coefficient Limits

The symmetrical tolerances apply to 2 point measurement of temperature coefficient, one at +25°C and the other at +85°C. To establish tolerances at -55°C requires a calculation which allows for curvature:

1. The positive tolerance from +25°C to -55°C is the same as that used for +85°C.

2. The negative tolerance from +25°C to -55°C (ppm/°C) = -36 -1.22 × specified positive tolerance + 0.22 × nominal temperature coefficient.

Example 1 -- P7H(+150 ± 60ppm/°C at +85°C)

Negative tol. = -36 -1.22(pos. tol) + 0.22(nominal T.C.)
= -36 -1.22(+60) + 0.22(+150)
= -36 -73.2 + 33
= -76.2ppm/°C

Neg. Limit at -55°C = 150 -76.2 = 73.8ppm/°C

Pos. Limit at -55°C = 150 +60.0 =210.0ppm/°C

Example 2 -- U2J(-750 ± 120ppm/°C at +85°C)

Negative tol. = -36 -1.22(Pos.Tol.) +0.22(nominal T.C.)
= -36 -1.22(+1.20)+0.22(-750)
= -36 -146.4 - 165
= -347.4ppm/°C

Neg. Limit at 55°C = -750 -347.4 = 1097.4ppm/°C

Pos. Limit at 55°C = -750 +120 = -630ppm/°C

1.4.1 Table of Temperature Coefficient Limits

TABLE IV

Permissible Capacitance Change from 25°C (ppm/°C)

Characteristic		At -55°C		At +85°C	
		Most Neg.	Most Pos.	Most Neg.	Most Pos.
+ 150	P7k	- 158	+ 400	- 100	+ 400
	P7J	+ 0	+ 270	+ 30	+ 270
	P7H	+ 73	+ 210	+ 90	+ 210
	P7G	+ 110	+ 180	+ 120	+ 180
+ 100	M7K	- 219	+ 350	- 150	+ 350
	M7J	- 60	+ 220	- 20	+ 220
	M7H	+ 12	+ 160	+ 40	+ 160
	M7G	+ 49	+ 130	+ 70	+ 130
+ 33	S6K	- 300	+ 283	- 217	+ 283
	S6J	- 142	+ 153	- 87	+ 153
	S6H	- 68	+ 93	- 27	+ 93
	S6G	- 32	+ 63	+ 3	+ 63
0	C0k	- 341	+ 250	- 250	+ 250
	C0J	- 182	+ 120	- 120	+ 120
	C0H	- 109	+ 60	- 60	+ 60
	C0G	- 72	+ 30	- 30	+ 30
- 33	S1K	- 381	+ 217	- 283	+ 217
	S1J	- 222	+ 87	- 153	+ 87
	S1H	- 149	+ 27	- 93	+ 27
	S1G	- 112	- 3	- 63	- 3
- 75	U1K	- 432	+ 175	- 325	+ 175
	U1J	- 273	+ 45	- 195	+ 45
	U1H	- 200	- 15	- 135	- 15
	U1G	- 164	- 45	- 105	- 45

Table IV - cont'd

Characteristic		At -55°C Most Neg.	At -55°C Most Pos.	At +85°C Most Neg.	At +85°C Most Pos.
- 150	P2K	- 524	+ 100	- 400	+ 100
	P2J	- 365	- 30	- 270	- 30
	P2H	- 292	- 90	- 210	- 90
	P2G	- 255	- 120	- 180	- 120
- 220	R2K	- 609	+ 30	- 470	+ 30
	R2J	- 450	- 100	- 340	- 100
	R2H	- 377	- 160	- 280	- 160
	R2G	- 341	- 190	- 250	- 190
- 330	S2L	-1048	+ 170	- 830	+ 170
	S2K	- 743	- 80	- 580	- 80
	S2J	- 585	- 210	- 450	- 210
	S2H	- 511	- 270	- 390	- 270
- 470	T2K	- 914	- 220	- 720	- 220
	T2J	- 755	- 350	- 590	- 350
	T2H	- 682	- 410	- 530	- 410
- 750	U2M	-2171	+ 250	-1750	+ 250
	U2K	-1256	- 500	-1000	- 500
	U2J	-1097	- 630	- 870	- 630
	U2H	-1024	- 690	- 810	- 690
-1500	P3K	-2171	-1250	-1750	-1250
-2200	R3L	-3330	-1700	-2700	-1700
-3300	S3N	-7112	- 800	-5800	- 800
	S3L	-4672	-2800	-3800	-2800
-4700	T3M	-6990	-3700	-5700	-3700

1.5 Requirements

1.5.1 Detail requirements for individual styles. Detail requirements or exceptions applicable to individual styles of capacitors shall be as specified in the individual detail specifications. In the event of any conflict between requirements of this specification and the individual specifications, the later shall govern.

1.5.2 Capacitance

When measured as specified in 1.6.1, the capacitance shall be within the tolerance shown by the type designation.

1.5.3 Quality factor (Q)

1.5.3.1 For capacitance values 1000pF or less at 1MHz. When determined as specified in 1.6.2, the Q shall not be less than the value shown in Figure 1.

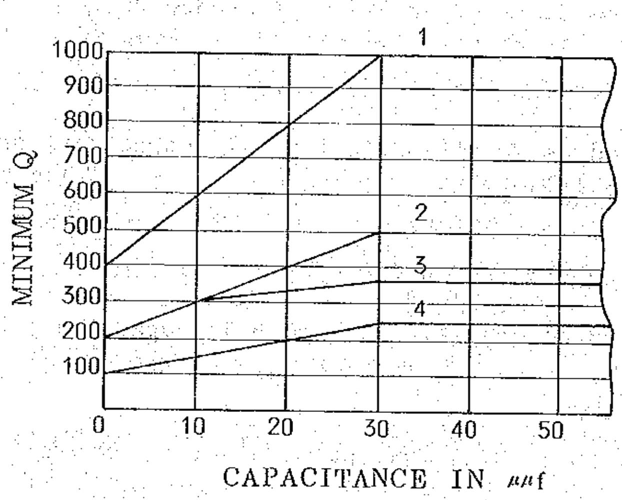


FIGURE 1

Curve 1 -- Initial Q for Temperature Coefficient values -1500ppm/°C and under.

Curve 2 -- Initial Q for Temperature Coefficient values above -1500ppm/°C and General Purpose.

Curve 3 -- Q after Life or Seal test, -1500ppm/°C and under.

Curve 4 -- Q after Life or Seal test, above -1500ppm/°C and General Purpose units.

1.5.3.2 For capacitance values above 1000pF at 1 kHz

Initial, 0.2% Max. D.F.

After Life and Seal test, 0.4% Max. D.F.

1.5.4 Insulation Resistance

When measured as specified in 1.6.3, the insulation resistance shall exceed 7500 megohms or an RC product of 75ΩF, whichever is less.

1.5.5 Dielectric Withstanding Voltage

When tested as specified in 1.6.4, capacitors shall withstand the DC potential without damage or breakdown.

1.5.6 Temperature Coefficient and Capacitance Drift

1.5.6.1 Temperature Coefficient

When tested as specified in 1.6.5.1, capacitors shall not exceed the limits as defined by Table IV.

1.5.6.2 Capacitance Drift

When tested as specified in 1.6.5.3, capacitance drift shall not exceed:

Through N750 : 0.3% max. or 0.25 pF, whichever is greater

Through N2200: 1.0% max.

Through N5600: 3.0% max.

1.5.7 Seal Test

When tested as specified in 1.6.6, capacitors shall meet the following requirements:

Capacitance ......change not more than 1% or 0.5pF, whichever is greater.

Q .... not less than that given in Figure 1.

Insulation Resistance .... not less than 1,000 megohms.

Dielectric Strength .... 2.5 times rated working voltage.

1.5.8 Life Test

When tested as specified in 1.6.7, capacitors shall meet the following requirements:

Capacitance .....change not more than 1% or 0.5pF, whichever is greater.

Q ....not less than that given in Figure 1.

Insulation Resistance .... not less than 1,000 megohms.

1.6 Method of Test

1.6.1 Capacitance (see paragraph 1.5.2)

Capacitance shall be measured in accordance with Method 305 of MIL-STD-202. The following details and exceptions shall apply:

(1) Test Frequency -- 1 MHz ± 100kHz when the capacitance is 1000pF and smaller; and 1kHz ± 100Hz when the capacitance is greater than 1000pF. Test voltage shall not exceed 2 Vrms.

1.6.2 Quality Factor (Q) (see paragraph 1.5.3)

The Q of the capacitor shall be determined in accordance with Method 306 of MIL-STD-202. The following detail shall apply:

(1) Test Frequency -- as specified in paragraph 1.6.1.

1.6.3 Insulation Resistance (see paragraph 1.5.4)

Capacitors shall be measured 1 minute after application of D.C. test voltage of 100 to 500 volts but not to exceed rated voltage. Capacitors rated at less than 100V shall be measured at rated voltage. Voltage to be applied through a resistor which will limit charging current to 50 milliamperes maximum.

1.6.4 Dielectric Withstanding Voltage (see paragraph 1.5.5)

(1) Capacitors shall withstand, for not less than 1 second, a D.C. test voltage of 2.5 times rated working voltage at nominal atmospheric pressure and a temperature of 25 ± 5°C. Voltage to be applied through a resistor which will limit charging current to 50 milliamperes maximum.

(2) Capacitors shall withstand, for not less than 1 second, a DC voltage of 1300 volts between both leads connected together and metal foil wrapped closely around body of capacitor to within no less than 1/16" of lead wires. Voltage to be applied through a resistor which will limit charging current to 50 milliamperes maximum.

1.6.5 Temperature Coefficient and Capacitance (see paragraph 1.5.6)

1.6.5.1 Capacitance measurements shall be made as specified:

	°C
(a)	+25,±
(b)	-55,±
(c) reference	+25,±
(d)	+85,±
(e)	+25,±

1.6.5.2 The temperature coefficient shall be computed as follows:

$$TC = \frac{(C_2 - C_1)\ 10^6}{(T_2 - T_1)\ C_1}$$

where

TC = Temperature Coefficient in parts per million per degree C.

C_1 = Capacitance at 25°C (reference, step c)

C_2 = Capacitance at test temperature

T_1 = 25°C, reference

T_2 = Test temperature in degree C.

1.6.5.3 Capacitance Drift -

Capacitance drift in percent shall be computed by dividing the greatest single difference between any two of the three values recorded at 25°C by the second value recorded at 25°C, multiplying this ratio by 100. Capacitance drift in pF shall be computed by subtracting the smallest capacitance value recorded from the largest of the three values recorded at 25°C.

1.6.6 Seal Test (see paragraph 1.5.7)

Capacitors shall be subjected to 5 cycles of temperature variations from 25°C to 15 minutes at -20°C, to 15 minutes at 25°C to 15 minutes at 85°C and back to 25°C at rate of temperature change not to exceed 2°C per minute. Subsequently the capacitor shall be subjected to a temperature of 40°C and relative humidity between 90% and 95% for 100 hours. Final measurements to be made not more than 30 minutes after completion of this conditioning and in an atmosphere of 10% to 50% relative humidity.

1.6.7 Life (see paragraph 1.5.8)

Capacitors shall be subjected to application of a D.C. voltage equal to 2 times rated working voltage for 250 hours at 85°C ± 3°C. The surge current shall not exceed 50 milliamperers. Final measurements to be made after this conditioning.

2. CERAMIC DIELECTRIC CAPACITORS, CLASS 2

2.1 Scope

Components of this classification are fixed, ceramic dielectric capacitors of a type suited for by-pass and coupling application or for frequency discriminating circuits where Q and stability of capacitance characteristic are not of major importance.

Class 2 ceramic dielectric exhibit a predictable capacitance change with time and voltage. Compensation for the aging effect is made by referencing capacitance limits to a future time deemed to be most useful to the buyer; 1000 hours is normally chosen, but other arrangements may be negotiated between buyer and seller. Voltage will also cause a temporary capacitance change and test sequence should be such that capacitance measurements are not affected by previous voltage tests.

The aging rate of a dielectric is essentially constant over many decades of time, i.e. 10 to 100, 100 to 1000, 1000 to 10,000, etc. hours when measured from the time of the last heat of depolarization or manufacture. Restoration of the original capacitance at time of manufacture will occur on heating to 150°C for one hour; after which normal aging will again commence. Capacitors measured prior to 1000 hours may exhibit temporarily high capacitance values which will age downward.

2.2 Classification

2.2.1 Type Designation

The type designation shall be in the following form, and as defined in Table V:

CCXXXX	Z5S	221	M	100
↓	↓	↓	↓	↓
Styk	Characteristic	Capacitance	Tol.	Voltage

TYPE DESIGNATION CODE

TABLE V

CCXX20 Z 5 S 22 1 M 15 1

Style (see 2.2.2)

Low Temp. Require-ment	Letter Symbol	High Temp. Require-ment	Numeri-cal Symbol	Max. Capaci. Change Over Temp. Range	Letter Symbol	1st + 2nd Significant Figure of Capacitance	Multiplier (See Note Below)	Numeri-cal Symbol	Tolerance on Capacitance	Letter Symbol	Voltage Rating		
											1st + 2nd Signifi-cant Fig.	Multi-plier	Numerical Symbol
+10°C	Z	+45°C	2	+1.0%	A		1	0				1	0
-30°C	Y	+65°C	4	±1.5%	B		10	1				10	1
-55°C	X	+85°C	5	±2.2%	C		100	2	±5%	J		100	2
		+105°C	6	±3.3%	D		1,000	3	±10%	K		1000	
		+125°C	7	±4.7%	E		10,000	4	±20%	M			
				±7.5%	F		100,000	5	+100%, -0%	P			
				±10.0%	P			-	+ 80%,-20%	Z			
				±15.0%	R			-					
				±22.0%	S		.01	8					
				+22%, -35%	T		.1	9					
				+22%, -56%	U								
				+22%, -82%									

Note 1: Use lowest decimal multiplier to avoid alternate coding; for example, 2.0pF should be 209, not 020.

Note 2: Listing of complete range of characteristics does not necessarily imply commercial availability of all values, but is for the purpose of providing a standard identification code for future development.

Note 3: X7R was formerly noted by industry as W5R.

2.2.2 Style

The style is identified by the two letter symbol "CC" followed by a two; three, or four digit number; the letters identify the item as an EIA RS-198 part and the number identifies the shape and dimensions of the capacitor (see individual detail specifications).

2.2.3 Characteristic

The characteristic is identified by a letter, digit, letter symbol in accordance with Table V. The letter and digit identify the Temperature Range and the second letter identifies the maximum capacitance change over the temperature range.

2.2.4 Capacitance and Tolerance

The capacitance and tolerance are identified by three digits and a letter symbol in accordance with Table V. The first and second digits identify the first and second significant figures of the capacitance, the third digit identifies the multiplier and the fourth letter identifies the capacitance tolerance.

2.2.5 Voltage

The voltage is identified by three digi ts in accordance with Table V. The first and second digits identify the first and second significant figures of the voltage and the third digit identifies the multiplier.

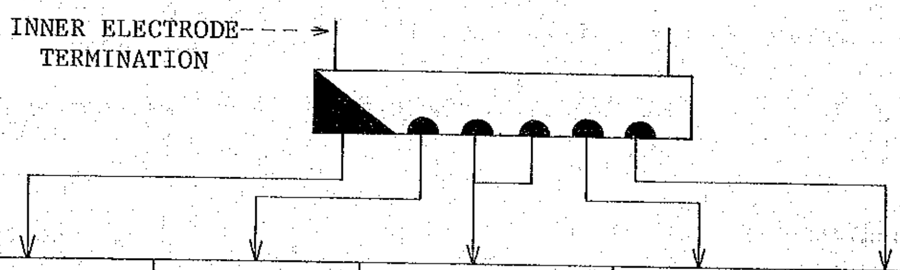
2.3 Marking

The color marking of fixed tubular ceramic dielectric capacitors -- Class II shall consist of 6 colors in accordance with Table VI. Dots or bands may be used providing first color position is easily recognizable by being distinctly different from the other. Table VI illustrates application to tubular styles. For disc and plate styles, color code shall read from left to right as observed with the lead wires downward, and, of course, no inner electrode identification is applicable.

Inner electrode terminal on tubular styles shall be indicated by easily discernible dot or depression OR by locating end color adjacent to inner electrode terminal as shown in Table VI.

TABLE VI

Values shown are standard.



Temp. Range for Characteristic Determination	Max. Capac. Change over Temp. Range	1st & 2nd Significant Figure of Capacitance	Multiplier	Tolerance on Capacitance	Color
-55°C to +85°C	± 1%	-	-	-	Gold
-30°C to +85°C	± 1.5%	-	-	-	Silver
	± 2.2%	0	1	±20%	Black
+10°C to +85°C	± 3.3%	1	10	-	Blown
-55°C to +125°C	± 4.7%	2	100	-	Red
+10°C to +65°C	± 7.5%	3	1000	-	Orange
	±10.0%	4	10,000	+100%, -0%	Yellow
	±15.0%	5	-	±5%	Green
	±22.0%	6	-	-	Blue
	+22%, -33%	7	-	-	Violet
	+22%, -56%	8	0.01	+80%,-20%	Gray
	+22%, -82%	9	0.1	±10%	White

Note 1: Use lowest decimal multipler to avoid alternate coding; for example, 2.0pF should be red, black, white; not black, red, black.

Note 2: Listening of complete range of characteristics does not necessarily imply commercial availability of all values, but is for the purpose of providing a standard identification code for future development.

2.4 Requirements

2.4.1 Detail Requirements for Individual Styles

Detail requirements or exceptions applicable to individual styles of capacitors shall be as specified in the individual specification sheets. In the event of any conflict between requirements of this specification and the individual specification sheets, the latter shall govern.

2.4.2 Capacitance

When measured as specified in 2.5.1, the capacitance shall be within the tolerance shown by the type designation.

2.4.3 Dissipation Factor (D.F.)

When measured as specified in 2.5.2, the D.F. shall not be greater than 2.5%.

2.4.4 Insulation Resistance

When measured as specified in 2.5.3, the insulation resistance shall exceed 7500 megohms or an RC product of 75ΩF, whichever is less.

2.4.5 Dielectric Withstanding Voltage

When tested as specified in 2.5.4, capacitors shall withstand the DC potential without damage or breakdown.

2.4.6 Temperature Characteristic

When tested as specified in 2.5.5, capacitors shall not exceed the limits as defined by Table V.

2.4.7 Seal Test

When tested as specified in 2.5.6, capacitors shall meet the following requirements:

Capacitance .... change not more than 20%.

Dissipation Factor .... not greater than 5%.

Insulation Resistance .... not less than 500 megohms.

Dielectric Strength .... 2.5 times rated working voltage.

2.4.8 Life

When tested as specified in 2.5.7, capacitors shall meet the following requirements:

Capacitance.................................... change not to exceed ±20%.

Dissipation Factor .... 5% maximum.

Insulation Resistance .... not less than 500 megohms.

2.5 Methods of Test

2.5.1 Capacitance (see paragraph 2.4.2)

Capacitance shall meet the requirements of 2.4.2 when measured at, or referred to, a frequency of 1kHz with an applied voltage of 1 ± .2Vrms.

2.5.2 Dissipation Factor (see paragraph 2.4.3)

Dissipation factor shall meet the requirements of 2.4.3 when measured as in 2.5.1.

2.5.3 Insulation Resistance (see paragraph 2.4.4)

Insulation resistance between terminals of the capacitor shall meet the requirements of 2.4.4 when measured 1 minute after application of DC test voltage of 100 to 500V, but not to exceed rated voltage. Capacitors rated at less than 100V shall be measured at rated voltage. Charging current shall be limited to 50 milliamperes maximum.

2.5.4 Dielectric Withstanding Voltage (see paragraph 2.4.5)

2.5.4.1 Capacitors shall withstand, for not less than 1 second, a D.C. test voltage of 2.5 times rated working voltage at nominal atmospheric pressure and a temperature of 25 ± 5°C. Voltage to be applied through a resistor which will limit charging current to 50 milliamperes maximum.

2.5.4.2 Capacitors shall withstand, for not less than 1 second, a D.C. voltage of 1300 volts between both leads connected together and metal foil wrapped closely around body of capacitor to within no less than 1/16" of lead wires. Voltage to be applied through a resistor which will limit charging current to 50 milliamperes maximum.

2.5.5 Temperature Characteristic

Capacitance measurements shall be made as specified:

	°C
(a)	25, ±2
(b)	Applicable low temperature, ±2
(c) reference	25, ±2
(d)	Applicable high temperature, ±2

2.5.6 Seal Test

After measuring capacitance as specified in 2.4.2, capacitors shall be subjected to 5 cycles of temperature variation from 25°C to 15 minutes at -20°C, to 15 minutes at 25°C to 15 minute at 85°C, and back to 25°C, rate of temperature change not to exceed 2°C per minute. Subsequently, capacitors shall be subjected to a temperature of 40°C and relative humidity between 90% and 95% for 100 hours. Final measurements to be made not more than 30 minutes after completion of this conditioning, and in an atmosphere of 10% to 50% relative humidity.

2.5.7 Life Test

Capacitors shall be tested for a period of 250 hours at maximum rated temperature at 200% rated voltage. The surge current shall not exceed 50 milliamperes. Final measurements to be made after this conditioning.

3. CERAMIC DIELECTRIC CAPACITORS, CLASS 3

3.1 Scope

Components herein standardized are fixed ceramic dielectric capacitors of a type specifically suited for use in transistorized or other low voltage electronic circuits for by-pass, coupling or frequency determination, in which dielectric losses, high insulation resistance and capacitance stability are not of major consideration.

3.2 Object

The object of this specification is to establish uniform requirements for judging the mechanical, electrical and environmental characteristics of the class of capacitors herein standardized.

3.3 Terminology

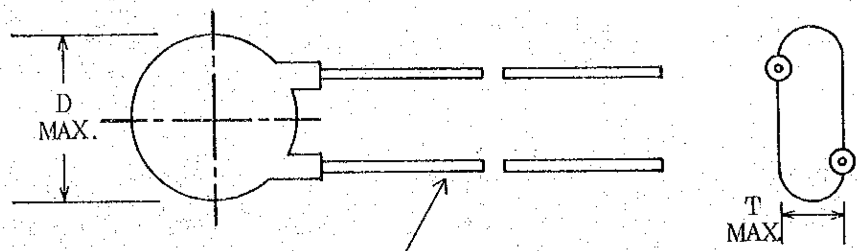
A Class 3 ceramic capacitor is one which has been formed on a semi-conducting or reduced titanate substate in which a barrier layer or diffusion zone has become the effective dielectric material.

3.4 Rated Characteristics

3.4.1 Rated Capacitance value of a component is that nominal value which is specified on the

E.I.A. STANDARD SPECIFICATION SHEET
FOR
CERAMIC DISC CAPACITORS
STYLE CC044

The complete requirements for procuring the capacitors described herein shall consist of this document and the issue in effect of E.I.A. Standard RS-198.



Copper or copper-clad wire, with tin or tin-lead alloy coating.

Inches	mm
.030	.76
.125	3.18
.156	3.96
.250	6.35
.440	11.18
1.250	31.75

Style	Max. Diameter (inches)	Max. Thickness (inches)	Lead Spacing (inches)	Resin Extension
CC044	.440	.156	.250 ± .230 in. at egress	.125 in. max.

EIA NUMBERING SYSTEM

CC 044 1 COG 240 J 501

- 501 — Voltage rating in volts. First two digits are significant; third digit specified the number of zeros that follow.
- J — Tolerance
- 240 — Capacitance in picofarads. First two digits are significant; third digit specifies the number of zeros that follow.
- COG — EIA Temperature Characteristic.
- 1 — Long leads #22 AWG, 1.25 in. min.
- 044 — Max. diameter in hundredths of an inch. All three digits are significant.
- CC — Style (CC signifies ceramic capacitor).

CLASS I-NPO-N4700

Cap.	NPO (C0)	N033 (S1)	N075 (U1)	N150 (P2)	N220 (R2)	N330 (S2)
24pF	CC0441C0G240J501	- - -	- - -	- - -	- - -	- - -
27	CC0441C0G270J501	CC0441S1G270J501	CC0441U1G270J501	- - -	- - -	- - -
30	CC0441C0G300J501	CC0441S1G300J501	CC0441U1G300J501	- - -	- - -	- - -
33	CC0441C0G330J501	CC0441S1G330J501	CC0441U1G330J501	CC0441P2G330J501	- - -	- - -
36	- - -	CC0441S1G360J501	CC0441U1G360J501	CC0441P2G360J501	- - -	- - -
39	- - -	- - -	CC0441U1G390J501	CC0441P2G390J501	CC0441R2G390J501	CC0441S2H390J501
43	- - -	- - -	CC0441U1G430J501	CC0441P2G430J501	CC0441R2G430J501	CC0441S2H430J501
47	- - -	- - -	- - -	CC0441P2G470J501	CC0441R2G470J501	CC0441S2H470J501
51	- - -	- - -	- - -	- - -	CC0441R2G510J501	CC0441S2H510J501
56	- - -	- - -	- - -	- - -	- - -	CC0441S2H560J501

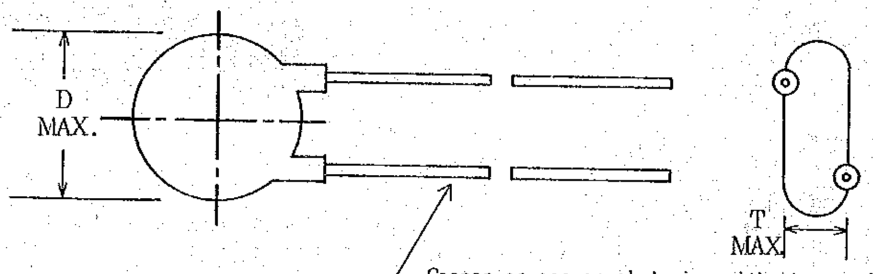
	N470(T2)	N750(U2)	N1500(P3)	N2200(R3)	N3300(S3)	N4700(T3)
47pF	CC0441T2H470J501	- - -	- - -	- - -	- - -	- - -
51	CC0441T2H510J501	- - -	- - -	- - -	- - -	- - -
56	CC0441T2H560J501	- - -	- - -	- - -	- - -	- - -
62	CC0441T2H620J501	CC0441U2J620J501	- - -	- - -	- - -	- - -
68	CC0441T2H680J501	CC0441U2J680J501	- - -	- - -	- - -	- - -
75	- - -	CC0441U2J750J501	CC0441P3K750J501	- - -	- - -	- - -
82	- - -	CC0441U2J820J501	CC0441P3K820J501	- - -	- - -	- - -
91	- - -	CC0441U2J910J501	CC0441P3K910J501	- - -	- - -	- - -
100	- - -	- - -	CC0441P3K101J501	- - -	- - -	- - -
110	- - -	- - -	CC0441P3K111J501	- - -	- - -	- - -
120	- - -	- - -	CC0441P3K121J501	- - -	- - -	- - -
130	- - -	- - -	- - -	CC0441R3L131J501	- - -	- - -
150	- - -	- - -	- - -	CC0441R3L151J501	- - -	- - -
160	- - -	- - -	- - -	CC0441R3L161J501	- - -	- - -
180	- - -	- - -	- - -	CC0441R3L181J501	- - -	- - -
360	- - -	- - -	- - -	- - -	- - -	CC0441T3M361J501
390	- - -	- - -	- - -	- - -	- - -	CC0441T3M391J501
430	- - -	- - -	- - -	- - -	- - -	CC0441T3M431J501
470	- - -	- - -	- - -	- - -	- - -	CC0441T3M471J501
510	- - -	- - -	- - -	- - -	- - -	CC0441T3M511J501

CLASS II

CAP.	X5F 500V	Z5P 500V	Z5U 500V	Z5P 200V	Z5U 100V
820pF	CC0441X5F821K501	- - -	- - -	- - -	- - -
.001µF	CC0441X5F102K501	CC0441Z5P122K501	- - -	- - -	- - -
.0012	CC0441X5F122K501	CC0441Z5P122K501	- - -	- - -	- - -
.0033	- - -	- - -	CC0441Z5U332M501	CC0441Z5P332M201	- - -
.0039	- - -	- - -	- - -	CC0441Z5P392M201	- - -
.0047	- - -	- - -	CC0441Z5U472M501	- - -	- - -
.0068	- - -	- - -	- - -	- - -	CC0441Z5U682M101
.01	- - -	- - -	- - -	- - -	CC0441Z5U103M101

E.I.A. STANDARD SPECIFICATION SHEET
FOR
CERAMIC DISC CAPACITORS
STYLE CC049

The complete requirements for procuring the capacitors described herein shall consist of this document and the issue in effect of E.I.A. Standard RS-198.



Inches	mm
.030	.76
.125	3.18
.156	3.96
.250	6.35
.490	12.45
1.250	31.75

Style	Max. Diameter (inches)	Max. Thickness (inches)	Lead Spacing (inches)	Resin Extension
CC049	.490	.156	.250 ± .30 in. at egress	.125 in. max.

EIA NUMBERING SYSTEM

CC 049 1 COG 360 J 501

- 501 — Voltage rating in volts. First two digits are significant; third digit specified the number of zeros that follow.
- J — Tolerance
- 360 — Capacitance in picofarads. First two digits are significant; third digit specifies the number of zeros that follow.
- COG — EIA Temperature Characteristic
- 1 — Long leads #22 AWG, 1.25 in. min.
- 049 — Max. diameter in hundredths of an inch. All three digits are significant.
- CC — Style (CC signifies ceramic capacitor).

CLASS I-NPO-N4700
500V

Cap.	NPO (CO)	N033 (S1)	N075 (U1)	N150 (P2)	N220 (R2)	N330 (S2)
36pF	CC0491C0G360J501	- - -	- - -	- - -	- - -	- - -
39	CC0491C0G390J501	CC0491S1G390J501	- - -	- - -	- - -	- - -
43	CC0491C0G430J501	CC0491S1G430J501	- - -	- - -	- - -	- - -
47	CC0491C0G470J501	CC0491S1G470J501	CC0491U1G470J501	- - -	- - -	- - -
51	CC0491C0G510J501	CC0491S1G510J501	CC0491U1G510J501	CC0491P2G510J501	- - -	- - -
56	- - -	- - -	CC0491U1G560J501	CC0491R2G560J501	CC0491R2G560J501	- - -
62	- - -	- - -	- - -	CC0491P2G620J501	CC0491R2G620J501	CC0491S2H620J501
68	- - -	- - -	- - -	- - -	CC0491R2G680J501	CC0491S2H680J501
75	- - -	- - -	- - -	- - -	CC0491R2G750J501	CC0491S2H750J501

Cap.	N470 (T2)	N750 (U2)	N1500 (P3)	N2200 (R3)	N3300 (S3)	N4700 (T3)
75pF	CC0491T2H750J501	- - -	- - -	- - -	- - -	- - -
82	CC0491T2H820J501	- - -	- - -	- - -	- - -	- - -
91	CC0491T2H910J501	- - -	- - -	- - -	- - -	- - -
100	CC0491T2H101J501	CC0391U2J101J501	- - -	- - -	- - -	- - -
110	- - -	CC0491U2J111J501	- - -	- - -	- - -	- - -
120	- - -	CC0491U2J121J501	- - -	- - -	- - -	- - -
130	- - -	CC0491U2J131J501	CC0491P3K131J501	- - -	- - -	- - -
150	- - -	- - -	CC0491P3K151J501	- - -	- - -	- - -
160	- - -	- - -	CC0491P3K161J501	- - -	- - -	- - -
180	- - -	- - -	- - -	- - -	CC0491S3L181J501	- - -
200	- - -	- - -	- - -	- - -	CC0491S3L201J501	- - -
220	- - -	- - -	- - -	- - -	CC0491S3L221J501	- - -
240	- - -	- - -	- - -	- - -	CC0491S3L241J501	- - -
270	- - -	- - -	- - -	- - -	CC0491S3L271J501	- - -
300	- - -	- - -	- - -	- - -	CC0491S3L301J501	- - -
330	- - -	- - -	- - -	- - -	CC0491S3L331J501	- - -
360	- - -	- - -	- - -	- - -	CC0491S3L361J501	- - -
390	- - -	- - -	- - -	- - -	CC0491S3L391J501	- - -
430	- - -	- - -	- - -	- - -	CC0491S53L431J501	- - -
560	- - -	- - -	- - -	- - -	- - -	CC0491T3M561J501
620	- - -	- - -	- - -	- - -	- - -	CC0491T3M621J501
680	- - -	- - -	- - -	- - -	- - -	CC0491T3M681J501
750	- - -	- - -	- - -	- - -	- - -	CC0491T3M751J501

CLASS II

Cap.	Z5P 500V	Z5U 500V	Z5P 200V
.0015µF	CC0491Z5P152K501	- - -	- - -
.0018	CC0491Z5P182K501	- - -	- - -
.0047	- - -	- - -	CC0491Z5P472M201
.0056	- - -	- - -	CC0491Z5P562M201
.0068	- - -	CC0491Z5U682M501	- - -

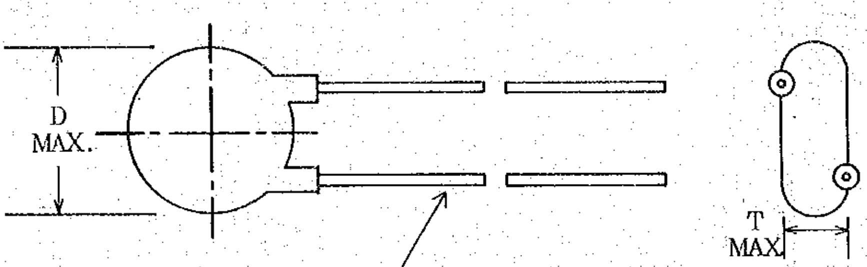
E.I.A. STANDARD SPECIFICATION SHEET

FOR

CERAMIC DISC CAPACITORS

STYLE CC059

The complete requirements for procuring the capacitors described herein shall consist of this document and the issue in effect of E.I.A. Standard RS-198.



Inches	mm
.030	.76
.125	3.17
.156	3.96
.375	9.52
.590	14.99
1.250	31.75

Style	Max. Diameter (inches)	Max. Thickness (inches)	Lead Spacing (inches)	Resin Extension
CC059	.590	.156	.375 ± .030 in. at egress	.125 in. max.

EIA NUMBERING SYSTEM

CC 059 1 COG 510 J 501

- 501 — Voltage rating in volts. First two digits are significant; third digit specifies the number of zeros that follow.
- J — Tolerance
- 510 — Capacitance in picofarads. First two digits are significant; third digit specifies the number of zeros that follow.
- COG — EIA Temperature Characteristic.
- 1 — Long leads #22 AWG, 1.25 in. min.
- 059 — Max. diameter in hundredths of an inch. All three digits are significant.
- CC — Style (CC signifies ceramic capacitor).

CLASS I-NPO-N4700

500V

Cap.	NPO(CO)	N033(S1)	N075(U1)	N150(P2)	N220(R2)	N330(S2)
51pF	CC0591COG510J501	- - -	- - -	- - -	- - -	- - -
56	CC0591COG560J501	CC0591S1G560J501	- - -	- - -	- - -	- - -
62	CC0591COG620J501	CC0591S1G620J501	CC0591U1G620J501	- - -	- - -	- - -
68	CC0591COG680J501	CC0591S1G680J501	CC0591U1G680J501	CC0591P2G680J501	- - -	- - -
75	CC0591COG750J501	CC0591S1G750J501	CC0591U1G750J501	CC0591P2G750J501	- - -	- - -
82	- - -	- - -	CC0591U1G820J501	CC0591P2G820J501	CC0591R2G820J501	CC0591S2H820J501
91	- - -	- - -	- - -	CC0591P2G910J501	CC0591R2G910J501	CC0591S2H910J501
100	- - -	- - -	- - -	- - -	CC0591R2G101J501	CC0591S2H101J501
110	- - -	- - -	- - -	- - -	- - -	CC0591S2H111J501

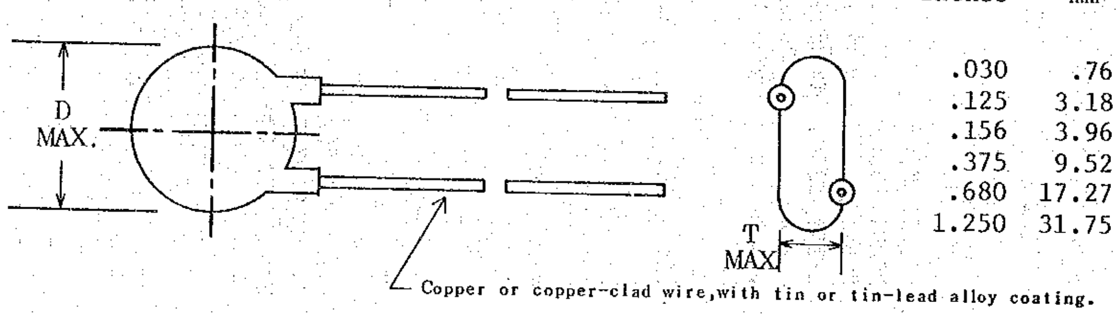
Cap.	N470(T2)	N750(U2)	N1500(P3)	N2200(R3)	N3300(S3)	N4700(T3)
110pF	CC0591T2H111J501	- - -	- - -	- - -	- - -	- - -
120	CC0591T2H121J501	- - -	- - -	- - -	- - -	- - -
130	CC0591T2H131J501	- - -	- - -	- - -	- - -	- - -
150	- - -	CC0591U2J151J501	- - -	- - -	- - -	- - -
160	- - -	CC0591U2J161J501	- - -	- - -	- - -	- - -
180	- - -	- - -	CC0591P3K181J501	- - -	- - -	- - -
200	- - -	- - -	CC0591P3K201J501	CC0591R3L201J501	- - -	- - -
220	- - -	- - -	- - -	CC0591R3L221J501	- - -	- - -
240	- - -	- - -	- - -	CC0591R3L241J501	- - -	- - -
270	- - -	- - -	- - -	CC0591R3L271J501	- - -	- - -
300	- - -	- - -	- - -	CC0591R2L301J501	- - -	- - -
330	- - -	- - -	- - -	CC0591R3L331J501	- - -	- - -
360	- - -	- - -	- - -	CC0591R3L361J501	- - -	- - -
470	- - -	- - -	- - -	- - -	CC0591S3L471J501	- - -
510	- - -	- - -	- - -	- - -	CC0591S3L511J501	- - -
820	- - -	- - -	- - -	- - -	- - -	CC0591T3M821J501
910	- - -	- - -	- - -	- - -	- - -	CC0591T3M911J501
1000	- - -	- - -	- - -	- - -	- - -	CC0591T3M102J501

CLASS II

Cap.	S5F 500W	X5P 500V	Z5U 500V	Z5P 200V	Z5U 100V
.0015µF	CC0591X5F152K501	- - -	- - -	- - -	- - -
.0018	CC0591X5F182K501	- - -	- - -	- - -	- - -
.0022	CC0591X5F222K501	CC0591Z5P222K501	- - -	- - -	- - -
.0027	- - -	CC0591Z5P272K501	- - -	- - -	- - -
.0068	- - -	- - -	- - -	CC0591Z5P682M201	- - -
.0082	- - -	- - -	- - -	CC0591Z5P822M201	- - -
.01	- - -	- - -	CC0591Z5U103M501	- - -	- - -
.015	- - -	- - -	- - -	- - -	CC0591Z5U153M101
.022	- - -	- - -	- - -	- - -	CC0591Z5U223M101

E.I.A. STANDARD SPECIFICATION SHEET
FOR
CERAMIC DISC CAPACITORS
STYLE CC068

The complete requirements for procuring the capacitors described herein shall consist of this document and the issue in effect of E.I.A. Standard RS-198.



Inches	mm
.030	.76
.125	3.18
.156	3.96
.375	9.52
.680	17.27
1.250	31.75

Style	Max. Diameter (inches)	Max. Thickness (inches)	Lead Spacing (inches)	Resin Extension
CC068	.680	.156	.375 ± .030 in. at egress	.125 in. max.

EIA NUMBERING SYSTEM

CC 068 1 COG 820 J 501

- 501 — Voltage rating in volts. First two digits are significant; third digit specifies the number of zeros that follow.
- J — Tolerance.
- 820 — Capacitance in picofarads. First two digits are significant; third digit specifies the number of zeros that follow.
- COG — EIA Temperature Characteristic.
- 1 — Long leads #22 AWG, 1.25 in. min.
- 068 — Max. diameter in hundredths of an inch. All three digits are significant.
- CC — Style (CC signifies ceramic capacitor).

CLASS I - NPO - N4700

500V

Cap.	NP (C0)	N033(S1)	N075(U1)	N150(P2)	N220(R2)	N330(S2)
82pF	CC0681C0G820J501	CC0681S1G820J501	- - -	- - -	- - -	- - -
91	CC0681C0G910J501	CC0681S1G910J501	CC0681U1G910J501	- - -	- - -	- - -
100	CC0681C0G101J501	CC0681S1G101J501	CC0681U1G101J501	CC0681P2G101J501	- - -	- - -
110	- - -	CC0681S1G111J501	CC0681U1G111J501	CC0681P2G111J501	CC0681R2G111J501	- - -
120	- - -	- - -	CC0681U1G121J501	CC0681P2G121J501	CC0681R2G121J501	CC0681S2H121J501
130	- - -	- - -	- - -	CC0681P2G131J501	CC0681R2G131J501	CC0681S2H131J501
150	- - -	- - -	- - -	- - -	CC0681R2G151J501	CC0681S2H151J501
160	- - -	- - -	- - -	- - -	CC0681R2G161J501	CC0681S2H161J501

Cap.	N470(T2)	N750(U2)	N1500(P3)	N2200(R3)	N3300(S3)	N4700(T3)
150pF	CC0681T2H151J501	- - -	- - -	- - -	- - -	- - -
160	CC0681T2H161J501	- - -	- - -	- - -	- - -	- - -
180	CC0681T2H181J501	CC0681J2J181J501	- - -	- - -	- - -	- - -
200	- - -	CC0681U2J201J501	- - -	- - -	- - -	- - -
220	- - -	CC0681U2J221J501	CC0681P3K221J501	- - -	- - -	- - -
240	- - -	CC0681U2J241J501	CC0681P3K241J501	- - -	- - -	- - -
270	- - -	CC0681U2J271J501	CC0681P3K271J501	- - -	- - -	- - -
300	- - -	- - -	CC0681P3K301J501	- - -	- - -	- - -
330	- - -	- - -	CC0681P3K331J501	- - -	- - -	- - -
390	- - -	- - -	- - -	CC0681R3L391J501	- - -	- - -
430	- - -	- - -	- - -	CC0681R3L431J501	- - -	- - -
470	- - -	- - -	- - -	CC0681R3L471J501	- - -	- - -
560	- - -	- - -	- - -	- - -	CC0681S3L561J501	- - -
620	- - -	- - -	- - -	- - -	CC0681S3L621J501	- - -
680	- - -	- - -	- - -	- - -	CC0681S3L681J501	- - -
750	- - -	- - -	- - -	- - -	CC0681S3L751J501	- - -
1100	- - -	- - -	- - -	- - -	- - -	CC0681T3M112J501
1200	- - -	- - -	- - -	- - -	- - -	CC0681T3M122J501
1300	- - -	- - -	- - -	- - -	- - -	CC0681T3M132J501
1500	- - -	- - -	- - -	- - -	- - -	CC0681T3M152J501
1600	- - -	- - -	- - -	- - -	- - -	CC0681T3M162J501

CLASS II

Cap.	X5F 500V	Z5P 500V	Z5U 500V	Z5P 200V	Z5U 100V
.0027µF	CC0681X5F272K501	- - -	- - -	- - -	- - -
.0033	CC0681X5F332K501	CC0681Z5P332K501	- - -	- - -	- - -
.0039	- - -	CC0681Z5P392K501	- - -	- - -	- - -
.01	- - -	- - -	- - -	CC0681Z5P103M201	- - -
.012	- - -	- - -	- - -	CC0681Z5P123M201	- - -
.015	- - -	- - -	CC0681Z5U153M501	- - -	- - -
.033	- - -	- - -	- - -	- - -	CC0681Z5U333M101

E.I.A. STANDARD SPECIFICATION SHEET

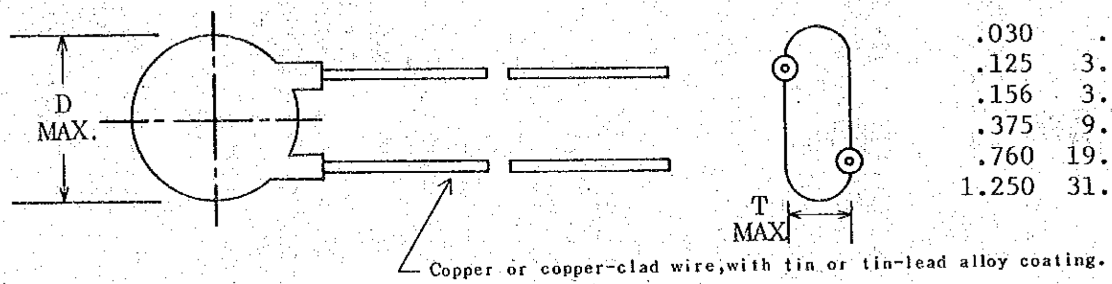
FOR

CERAMIC DISC CAPACITORS

STYLE CC076

The complete requirements for procuring the capacitors described herein shall consist of this document and the issue in effect of E.I.A. Standard RS-198.

Inches	mm
.030	.76
.125	3.18
.156	3.96
.375	9.52
.760	19.30
1.250	31.75



Style	Max. Diameter (inches)	Max. Thickness (inches)	Lead Spacing (inches)	Resin Extension
CC076	.760	.156	.375 ± .030 in. at egress	.125 in. max.

EIA NUMBERING SYSTEM

CC 076 1 COG 111 J 501

- 501 — Voltage rating in volts. First two digits are significant; third digit specifies the number of zeros that follow.
- J — Tolerance
- 111 — Capacitance in picofarads. First two digits are significant; third digit specifies the number of zeros that follow.
- COG — EIA Temperature Characteristic.
- 1 — Long leads #22 AWG, 1.25 in. min.
- 076 — Max. diameter in hundredths of an inch. All three digits are significant.
- CC — Style (CC signifies ceramic capacitor).

CLASS I-NPO-N4700

Cap.	NPO(CO)	N033(S1)	N075(U1)	N150(P2)	M220(R2)	N330(S2)
110pF	CC0761C0G111J501	- - -	- - -	- - -	- - -	- - -
120	CC0761C0G121J501	CC0761S0G121J501	- - -	- - -	- - -	- - -
130	CC0761C0G131J501	CC0761S1G131J501	CC0761U1G131J501	- - -	- - -	- - -
150	- - -	CC0761S1G151J501	CC0761U1G151J501	CC0761P2G151J501	- - -	- - -
160	- - -	- - -	- - -	CC0761P2G161J501	- - -	- - -
180	- - -	- - -	- - -	- - -	CC0761R2G181J501	CC0761S2H181J501
200	- - -	- - -	- - -	- - -	CC0761R2G201J501	CC0761S2H201J501

Cap.	N470(T2)	N750(U2)	N1500(Pa)	N2220(R3)	N3300(S3)	N4700(T3)
200pF	CC0761T2H201J501	- - -	- - -	- - -	- - -	- - -
220	CC0761T2H221J501	- - -	- - -	- - -	- - -	- - -
240	CC0761T2H241J501	- - -	- - -	- - -	- - -	- - -
270	CC0761T2H271J501	- - -	- - -	- - -	- - -	- - -
300	- - -	CC0761U2J301J501	- - -	- - -	- - -	- - -
330	- - -	CC0761U2J331J501	- - -	- - -	- - -	- - -
360	- - -	- - -	CC0761P3K361J501	- - -	- - -	- - -
390	- - -	- - -	CC0761P3K391J501	- - -	- - -	- - -
430	- - -	- - -	CC0761P3K431J501	- - -	- - -	- - -
510	- - -	- - -	- - -	CC0761R3L511J501	- - -	- - -
560	- - -	- - -	- - -	CC0761R3L561J501	- - -	- - -
620	- - -	- - -	- - -	CC0761R3L621J501	- - -	- - -
820	- - -	- - -	- - -	- - -	CC0761S3L821J501	- - -
910	- - -	- - -	- - -	- - -	CC0761S3L911J501	- - -
1000	- - -	- - -	- - -	- - -	CC0761S3L102J501	- - -
1800	- - -	- - -	- - -	- - -	- - -	CC0761T3M182J501
2000	- - -	- - -	- - -	- - -	- - -	CC0761T3M202J501

CLASS II

Cap.	X5F 500V	Z5P 500V	Z5U 500V	Z5U 100V
.0039 (µF)	CC0761X5F392K501	- - -	- - -	- - -
.0047	- - -	CC0761Z5P472K501	- - -	- - -
.0056	- - -	CC0761Z5P562K501	- - -	- - -
.022	- - -	- - -	CC0761Z5U223M501	- - -
.047	- - -	- - -	- - -	CC0761Z5U473M101
.068	- - -	- - -	- - -	CC0761Z5U683M101
.1	- - -	- - -	- - -	CC0761Z5U104M101

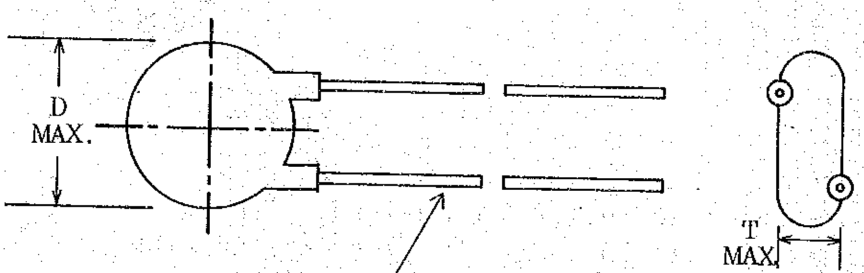
E.I.A. STANDARD SPECIFICATION SHEET

FOR

CERAMIC DISC CAPACITORS

STYLE CC089

The complete requirements for procuring the capacitors described herein shall consist of this document and the issue in effect of E.I.A. Standard RS-198.



Inches	mm
.030	.76
.125	3.18
.156	3.96
.375	9.52
.890	22.61
1.250	31.75

Style	Max. Diameter (inches)	Max. Thickness (inches)	Lead Spacing (inches)	Durez Extension
CC089	.890	.156	.375 ± .030 in. at egress	.125 in. max.

EIA NUMBERING SYSTEM

CC 089 1 COG 151 J 501

- 501 — Voltage rating in volts. First two digits are significant; third digit specifies the number of zeros that follow.
- J — Tolerance.
- 151 — Capacitance in picofarads. First two digits are significant; third digit specifies the number of zeros that follow.
- COG — EIA Temperature Characteristic.
- 1 — Long leads #22 AWG, 1.25 in. min.
- 089 — Max. diameter in hundredths of an inch. All three digits are significant.
- CC — Style (CC signifies ceramic capacitor).

CLASS I-NPO-N4700
500V

Cap.	NPO(CO)	N033(S1)	N075(U1)	N150(P2)	M220(R2)	N330(S2)
150pF	CC0891COG151J501	– – –	– – –	– – –	– – –	– – –
160	CC0891COG161J501	CC0891S1G161J501	CC0891U1G161J501	– – –	– – –	– – –
180	CC0891COG181J501	CC0891S1G181J501	CC0891U1G181J501	CC0891P2G181J501	– – –	– – –
200	CC0891COG201J501	CC0891S1G201J501	CC0891U1G201J501	CC0891P2G201J501	– – –	– – –
220	– – –	CC0891S1G221J501	CC0891U1G221J501	CC0891P2G221J501	CC0891R2G221J501	CC089152H221J501
240	– – –	– – –	CC0891U1G241J501	CC0891P2G241J501	CC0891R2G241J501	CC0891S2H241J501
270	– – –	– – –	CC0891U1G271J501	CC0891P2G271J501	CC0891R2G271J501	CC0891S2H271J501
300	– – –	– – –	– – –	CC0891P2G301J501	CC0891R2G301J501	CC0891S2H301J501

	N470(T2)	N750(U2)	N1500(P3)	N2200(R3)	N3300(S3)	N4700(T3)
300pF	CC0891T2H301J501	– – –	– – –	– – –	– – –	– – –
330	CC0891T2H331J501	– – –	– – –	– – –	– – –	– – –
360	CC0891T2H361J501	CC0891U2J361J501	– – –	– – –	– – –	– – –
390	CC0891T2H391J501	CC0891U2J391J501	– – –	– – –	– – –	– – –
430	– – –	CC0891U2J431J501	– – –	– – –	– – –	– – –
470	– – –	CC0891U2J471J501	CC0891P3K471J501	– – –	– – –	– – –
510	– – –	CC0891U2J511J501	CC0891P3K511J501	– – –	– – –	– – –
560	– – –	– – –	CC0891P3K561J501	– – –	– – –	– – –
620	– – –	– – –	CC0891P3K261J501	– – –	– – –	– – –
680	– – –	– – –	CC0891P3K681J501	CCo891R3L681J501	– – –	– – –
750	– – –	– – –	CC0891P3K751J501	CC0891R3L751J501	– – –	– – –
820	– – –	– – –	– – –	CC0891R3L821J501	– – –	– – –
910	– – –	– – –	– – –	CC0891R3L911J501	– – –	– – –
1100	– – –	– – –	– – –	– – –	CC0891S3L112J501	– – –
1200	– – –	– – –	– – –	– – –	CC0891S3L122J501	– – –
1300	– – –	– – –	– – –	– – –	CC0891S3L132J501	– – –
1500	– – –	– – –	– – –	– – –	CC0891S3L152J501	– – –
1600	– – –	– – –	– – –	– – –	CC0891S3L162J501	– – –
2200	– – –	– – –	– – –	– – –	– – –	CC0891T3M222J501

CLASS I-N470-N4700

Cap.	N470(T2)	N750(U2)	N1500(P3)	N2200(R3)	N3300(S3)	N4700(T3)
2400pF	- - -	- - -	- - -	- - -	- - -	CC0891T3M242J501
2700	- - -	- - -	- - -	- - -	- - -	CC0891T3M272J501
3000	- - -	- - -	- - -	- - -	- - -	CC0891T3M302J501
3300	- - -	- - -	- - -	- - -	- - -	CC0891T3M332J501
3600	- - -	- - -	- - -	- - -	- - -	CC0891T3M362J501

CLASS II

Cap.	X5F 500V	Z5P 500V
.0047µF	CC0891X5F472K501	- - -
.0056	CC0891X5F562K501	- - -
.0068	- - -	CC0891Z5P682K501

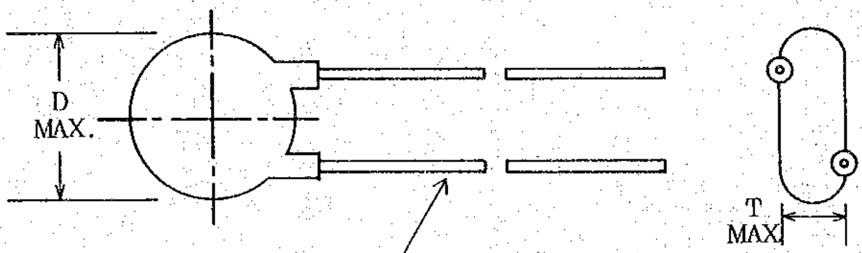
E.I.A. STANDARD SPECIFICATION SHEET

FOR

CERAMIC DISC CAPACITORS

STYLE CC111

The complete requirements for procuring the capacitors described herein shall consist of this document and the issue in effect of E.I.A. Standard RS-198.



Copper or copper-clad wire, with tin or tin-lead alloy coating.

Inches	mm.
.030	.76
.125	3.18
.156	3.96
.375	9.52
1.110	28.19
1.250	31.75

Style	Max. Diameter (inches)	Max. Thickness (inches)	Lead Spacing (inches)	Resin Extension
CC111	1.110	.156	.375 ± .030 in. at egress	.125 in. max.

EIA NUMBERING SYSTEM

CC 111 1 P3K 821 J 501

- 501 — Voltage rating in volts. First two digits are significant; third digit specifies the number of zeros that follow.
- J — Tolerance.
- 821 — Capacitance in picofarads. First two digits are significant; third digit specifies the number of zeros that follow.
- P3K — EIA Temperature Characteristic.
- 1 — Long leads #22 AWG, 1.25 in. min.
- 111 — Max. diameter in hundredths of an inch. All three digits are significant.
- CC — Style (CC signifies ceramic capacitor).

CLASS I-N470-N4700

500V

Cap.	N470(T2)	N750(U2)	N1500(P3)	N2200(R3)	N3300(S3)	N4700(T3)
820pF	- - -	- - -	CC1101P3K821J501	- - -	- - -	- - -
910	- - -	- - -	CC1101P3K911J501	- - -	- - -	- - -
1000	- - -	- - -	CC1101P3K102J501	CC1101R3L102J501	- - -	- - -
1100	- - -	- - -	CC1101P3K112J501	CC1101R3L112J501	- - -	- - -
1200	- - -	- - -	- - -	CC1101R3L122J501	- - -	- - -
1800	- - -	- - -	- - -	- - -	CC1101S3L182J501	- - -
2000	- - -	- - -	- - -	- - -	CC1101S3L202J501	- - -
3900	- - -	- - -	- - -	- - -	- - -	CC1101T3M392J501
4300	- - -	- - -	- - -	- - -	- - -	CC1101T3M432J501
4700	- - -	- - -	- - -	- - -	- - -	CC1101T3M472J501

CLASS II

Cap.	X5F 500V	Z5P 500V	Z5U 500V	Z5P 200V	Z5U 100V
.0068μF	CC1101X5F682K501	- - -	- - -	- - -	- - -
.0082	CC1101X5F822K501	CC1101Z5P822K501	- - -	- - -	- - -
.01	- - -	CC1101Z5P103K501	- - -	- - -	- - -
.012	- - -	CC1101Z5P123K501	- - -	- - -	- - -
.033	- - -	- - -	CC1101Z5U333M501	- - -	- - -
.047	- - -	- - -	CC1101Z5U473M501	- - -	- - -

3.9 C. T. R. L 試作品の電気的一般特性データ

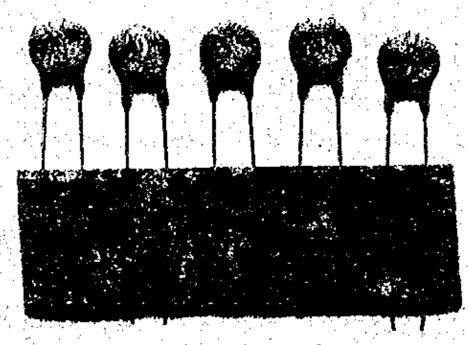
CERAMIC CAPACITOR　　TYPE

Date 16-4-1981　　Z5V 0.01μf Z 500W.V

No.	C (pF)	tan δ	IR (50V) (MΩ)	Test V DC (Volts)	Break down V DC (KV)	Break down V AC (KV)	Size of Fired Body
1	12300	0.011	1.8×10^5	1250 V	2.8		Thickness
2	12500	0.009	1.5×10^5	OK	2.6		0.43 mmφ
3	12700	0.009	1.8×10^5	"	3.0		
4	12300	0.010	1.8×10^5	"	3.0		Diameter
5	12900	0.011	1.8×10^5	"	2.9		8.3 mm
6	12300	0.009	1.8×10^5	"		1.4	
7	12500	0.009	1.6×10^5	"		1.3	Silver Dia
8	12800	0.0085	1.8×10^5	"		1.3	7.2 mmφ
9	12100	0.009	1.6×10^5	"		1.5	
10	12600	0.009	1.8×10^5	"		1.3	
11	12600	0.009	1.5×10^5	"			
12	13000	0.010	1.8×10^5	"			
13	12500	0.009	1.8×10^5	"			
14	12900	0.009	1.8×10^5	"			
15	12200	0.009	1.8×10^5	"			
MAX	13000	0.011	1.8×10^5		3.0^{KV}	1.5^{KV}	
MIN	12100	0.0085	1.5×10^5		2.6^{KV}	1.3^{KV}	

Sample

* Measured by YHP 4260A Universal Bridge (C & tanδ)
* Insulation Resistance by TOA Model SM-15E.
* Withstanding Voltage tester Kikusui Model 875Z.
  Break Down Voltage test.



Date 16-4-1981

CERAMIC CAPACITOR

TYPE Z5V 0.0047 Z 1kWV

No.	C (pF)	tan δ	IR (50V) (MΩ)	Test V DC (Volts)	Break down V DC (KV)	Break down V AC (KV)	Size of Fired Body
1	5350	0.007	2.8×10^5	2500 V	4.5		Thickness
2	5780	0.008	2.6×10^5	OK	4.2		1.03 mm
3	5500	0.008	2.2×10^5	"	4.2		
4	5630	0.0075	2.6×10^5	"	3.9		Diameter
5	5900	0.007	2.8×10^5	"	4.0		8.3 mm
6	5110	0.006	2.3×10^5	"		2.0	
7	6020	0.006	2.2×10^5	"		2.3	Silver Dia
8	5280	0.006	3.2×10^5	"		2.3	7.0 mmφ
9	5550	0.006	2.9×10^5	"		2.4	
10	5400	0.008	2.6×10^5	"		2.3	
11	5050	0.0065	2.2×10^5	"			
12	5880	0.0065	2.5×10^5	"			
13	5350	0.006	2.5×10^5	"			
14	5700	0.006	2.5×10^5	"			
15	5290	0.006	2.6×10^5	"			
MAX	6020	0.008	2.9×10^5		4.5^{kV}	2.4^{kV}	
MIN	5050	0.006	2.2×10^5		3.9^{kV}	2.0^{kV}	

Sample

* Measured by YHP 4260A Universal Bridge (C & tanδ)

* Insulation Resistance by TOA Model SM-15E.

* Withstanding Voltage tester Kikusui Model 875Z.
Break Down Voltage test.

Date 16-4-1981

CERAMIC CAPACITOR

TYPE Z5V0.0022Z 2KWV

No.	C (pF)	tan δ	IR (50V) (MΩ)	Test V DC (Volts)	Break down V DC (KV)	Break down V AC (KV)	Size of Fired Body
1	2810	0.006	3.0×10^5	5000 V	5.0 up		Thickness
2	2750	0.006	3.0×10^5	0 K	5.0 "		1.85 mm.
3	2500	0.0065	2.8×10^5	"	5.0 "		
4	2700	0.006	2.9×10^5	"	5.0 "		Diameter
5	2750	0.005	3.0×10^5	"	5.0 "		8.3 mmϕ
6	2630	0.007	2.5×10^5	"		3.9	Silver Dia
7	2790	0.006	2.8×10^5	"		4.0	7.0 mmϕ
8	2530	0.006	2.8×10^5	"		4.1	
9	2800	0.006	3.1×10^5	"		4.0	
10	2700	0.006	2.5×10^5	"		4.3	
11	2680	0.006	2.5×10^5	"			
12	2410	0.006	2.9×10^5	"			
13	2850	0.005	2.7×10^5	"			
14	2730	0.006	2.3×10^5	"			
15	2500	0.006	2.6×10^5	"			
MAX	2850	0.007	3.1×10^5		5000^{V} up	4.3^{kV}	
MIN	2410	0.005	2.3×10^5			3.9^{kV}	

Sample

* Measured by YHP 4260A Universal Bridge (C & tanδ)

* Insulation Resistance by TOA Model SM-15E.

* Withstanding Voltage tester Kikusui Model 875Z.
Break Down Voltage test.

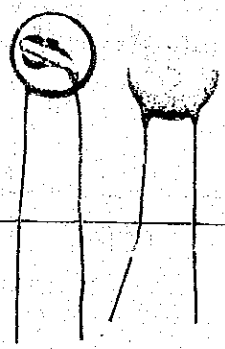
CERAMIC CAPACITOR TYPE

Date 16-411981

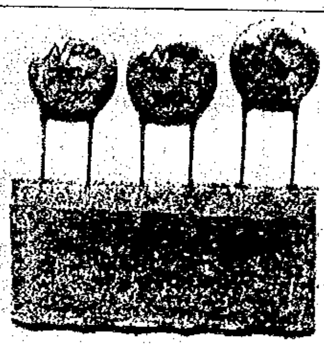
NPO 75pF±10% 500W.V

No.	C (pF)	tan δ Q	IR(50V) (MΩ)	Test V DC (Volts)	Break down V DC (KV)	 AC (KV)	Size of Fired Body
1	74.0	0.001	5.6×10^5	1250 V	5.0		Thickness
2	75.4	0.001	5.3×10^5	0 K "	4.8		0.42 m/m
3	74.8	0.0011	5.3×10^5	"	5.0		
4	75.4	0.0013	5.8×10^5	"	4.5		Diameter
5	75.2	0.001	5.5×10^5	"	4.5		12.2mmφ
6	74.9	0.001	5.0×10^5	"		3.5	
7	75.2	0.001	5.0×10^5	"		3.6	Silver Dia
8	75.4	0.001	5.0×10^5	"		3.3	11.0mmφ
9	75.6	0.0012	5.6×10^5	"		3.5	
10	74.0	0.001	5.3×10^5	"		3.5	
11	75.4	0.001	5.4×10^5	"			
12	74.7	0.001	5.0×10^5	"			
13	74.8	0.001	5.0×10^5	"			
14	75.0	0.001	5.2×10^5	"			
15	75.2	0.001	5.0×10^5	"			
MAX	75.6pF	0.0013	5.8×10^5 MΩ		5.0^{kV}	3.6^{kV}	
MIN	74.0pF	0.001	5.0×10^5 MΩ		4.5^{kV}	3.3^{kV}	

Sample



* Measured by YHP 4260A Universal Bridge (C & tanδ)
* Insulation Resistance by TOA Model SM-15E.
* Withstanding Voltage tester Kikusui Model 875Z. Break Down Voltage test.

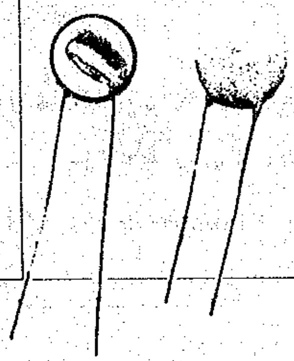


CERAMIC CAPACITOR

TYPE N750 150 pF $\pm 10\%$ 500WV

Date 16-4-1981

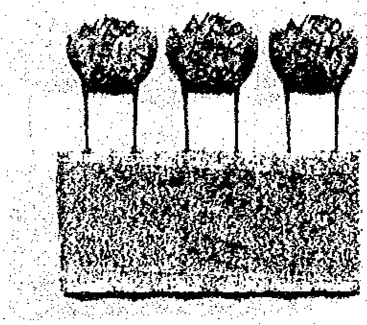
No.	C (pF)	tan δ	IR(50V) (MΩ)	Test V DC (Volts)	Break down V DC (KV)	Break down V AC (KV)	Size of Fired Body
1	154	0.0015	5.5×10^5	1250 V	4.8		Thickness
2	155	0.0016	5.3×10^5	0 K	4.0		0.48 m/mϕ
3	153	0.0013	5.5×10^5	"	4.5		
4	156	0.0013	6.0×10^5	"	4.8		Diameter
5	152	0.0017	4.8×10^5	"	4.8		12.2 mmϕ
6	155	0.0013	5.6×10^5	"		3.1	
7	155	0.0013	5.3×10^5	"		3.0	Silver Dia
8	153	0.0014	6.1×10^5	"		3.6	11.0 mm
9	153	0.0013	5.8×10^5	"		3.1	
10	154	0.0015	5.5×10^5	"		3.2	
11	156	0.0015	5.5×10^5	"			
12	153	0.0016	5.5×10^5	"			
13	152	0.0013	5.7×10^5	"			
14	155	0.0014	5.5×10^5	"			
15	155	0.0013	5.3×10^5	"			
MAX	156pF	0.0017	6.1×10^5 MΩ		4.8^{kV}	3.6^{kV}	
MIN	152pF	0.0013	5.3×10^5 MΩ		4.0^{kV}	3.1^{kV}	



* Measured by YHP 4260A Universal Bridge (C & tanδ)

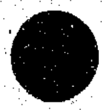
* Insulation Resistance by TOA Model SM-15E.

* Withstanding Voltage tester Kikusui Model 8752. Break Down Voltage test.

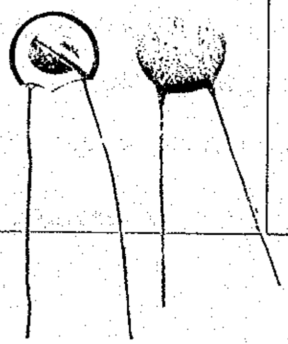


CERAMIC CAPACITOR　　TYPE

Date 16-4-1981　　Z5U0.015μf Z 500WV

No.	C (pF)	tan δ Q	IR (50V) (MΩ)	Test V DC (Volts)	Break down V DC (KV)	 AC (KV)	Size of Fired Body
1	15200	0.0085	1.5×10^5	1250 V	3.3		Thickness
2	14700	0.0087	2.0×10^5	0 K	2.8		0.42 m/m
3	15300	0.0085	2.5×10^5	"	3.2		
4	14700	0.0064	2.5×10^5	"	3.2		Diameter
5	14800	0.007	2.5×10^5	"	3.8		12.4mmφ
6	14800	0.007	2.0×10^5	"		1.5	
7	14300	0.008	1.5×10^5	"		1.5	Silver Dia
8	15300	0.0075	1.2×10^5	"		1.4	11.0mmφ
9	13700	0.009	1.2×10^5	"		1.5	
10	14900	0.008	1.2×10^5	"		1.4	
11	15500	0.0083	1.5×10^5	"			
12	15900	0.008	1.2×10^5	"			
13	14700	0.008	1.2×10^5	"			
14	16000	0.008	1.5×10^5	"			
15	13800	0.008	2.0×10^5	"			
MAX	16000	0.009	2.0×10^5		3.8^{kV}	1.5^{kV}	
MIN	13700	0.0064	1.2×10^5		2.8^{kV}	1.4^{kV}	

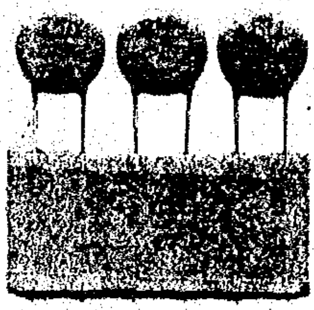
Sample



* Measured by YHP 4260A Universal Bridge (C & tanδ).

* Insulation Resistance by TOA Model SM-15E.

* Withstanding Voltage tester Kikusui Model 875Z.
  Break Down Voltage test.

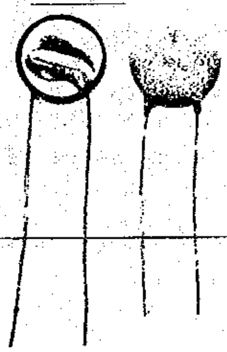


ERAMIC CAPACITOR TYPE

Date 16-4-1981 Z5V 0.022μF Z 500W.V

No.	C (pF)	tan δ Q	IR (50V) (MΩ)	Test V DC (Volts)	Break down V DC (KV)	Break down V AC (KV)	Size of Fired Body
1	23500	0.0095	2.2×10^5	1250 V	3.9		Thickness
2	23000	0.008	2.2×10^5	O K	3.8		0.52 m/m
3	22800	0.009	2.0×10^5	"	3.8		
4	24200	0.0095	2.5×10^5	"	4.1		Diameter
5	23900	0.0085	1.8×10^5	"	4.2		12.5 mmϕ
6	22500	0.008	1.8×10^5	"		1.9	
7	23700	0.008	2.2×10^5	"		2.0	Silver Dia
8	23500	0.008	2.5×10^5	"		2.0	11.0 mmϕ
9	24100	0.0085	1.5×10^5	"		1.9	
10	23300	0.007	1.6×10^5	"		1.9	
11	22600	0.007	2.0×10^5	"			
12	22500	0.007	2.2×10^5	"			
13	23800	0.0075	2.2×10^5	"			
14	23500	0.008	1.7×10^5	"			
15	24000	0.008	2.0×10^5	"			
MAX	24200	0.0095	2.5×10^5		4.2^{kV}	2.0^{kV}	
MIN	22500	0.007	1.5×10^5		3.8^{kV}	1.9^{kV}	

Sample

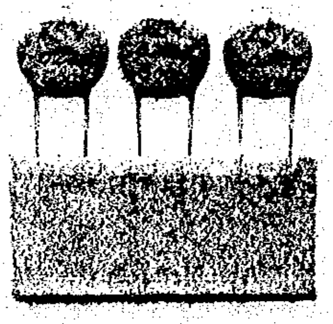


* Measured by YHP 4260A Universal Bridge (C & tan δ).

* Insulation Resistance by TOA Model SM-15E.

* Withstanding Voltage tester Kikusui Model 875Z.

Break Down Voltage test.



4. 回路部品(CERAMIC)研究員に望むこと

FOR COMPONENT RESEARCH WORKERS

1) Immediately after the experiment, you have to write down the test result in detail every day.

2) You are required to make an experiment with various kinds of combination and condition.

3) For component Research Workers, accademic philosophy is necessary, while it's more important to get a lot of idea by testing with various kinds of methods and means.

   Then it will lead you to success in discovery of new products.

4) As vital points of ceramic capacitor are compounding ratio of compositions and sintering technology, the intention in which you confront electric furnace without theory and a lot of experiment will surely lead you to success in understanding of porcelain.

5) When singular value is found in test process, you have to think it as an important point and to pursue it without over-looking.

6) I hope you will make an experiment with sensitive attitude, because discovery of new ceramic is left in the delicate point where crystal and boundary create.

Thank you very much for your cooperation during my stay in your laboratory.

Mikio Naisei

5. 結　　　論

(1) パキスタン電信電話総局中央電気通信研究所に対する技術協力に対し、実施期間の国際協力事業団ならびに郵政省から弊社に指導依頼を受けて約１ケ月間の短期指導員としてCERAMIC CAPACITOR の技術指導を行い前記報告の通り指導を行った。

(2) C.T.R.L で試作方法を習得し作成した CERAMIC　CAPACITORの試料について電気的性能の測定結果、一応の成果を得た。ＪＩＳ規格およびＥＩＡ規格を充分満足出来るデータを得て、研究に従事されたカウンターパート諸氏の自信を深めた。

(3) CERAMIC　CAPACITOR は窯業製品であって焼成技法の熟達とテクニックを習得する必要がある特殊な分野である。

窯業と化学、機械装置、電気等の広範囲におよぶ幅の広い分野の知識と非常に地味な実験の積重ねによって成り立つ部品であることを理解してもらった。

(4) 電子部品として誠に広範囲に利用される基礎技術でもあり工業生産品として多方面に活用される例を紹介した。

1）薄膜ＩＣの基板、ＩＣパッケージケース。

2）絶縁碍子の利用。耐電、耐熱材料としてガラス、ベーク板およびフィルム基板の代替としての応用。

3）熱交換器の耐熱部所の材料。

4）フェライト材料の製造技術と類似する製法。

5）サーミスタ、およびバリスターの製造法の近似性。

上記は何れも焼結技術を基本とする製品であることを説明し粉体成型と高温焼結の理念を凡そ理解してもらった。

(5) 電子部品の研究に従事するカウンターパートの各位は実習による技術習得する訓練が必要で、例えば試作試料製作のテクニックを取得する必要性を説明し特異な電気的あるいは物理的現象を注意深く観察することで新製品の開発のきっかけをつかむ具体的例を上げて理解してもらった。

(6) 日本国に於ける CERAMIC　CAPACITOR の量産方式および回路部品としての利用されている現状を話し、現在の国際レベルを認識するために、日本国の工場見学を積極的に推進されることを希望した。

6. 所　　　見

短期の指導で充分な実験と試料作成が果せなかったが一応初期の段階としての結果は得られたと思う。今後は更に努力して多種類の調合原料を駆使されて、C.T.R.L で回路部品として試料サンプルの供給が可能ならしめる様期待する。幾度となく表現したがCERAMIC CAPACITORなどの焼結物（高熱化学）の研究を手掛けるに当たって良く心すべきことは、窯業－電気－物理－化学－機械など多くの分野が関連しているテーマが多いために仕事の取りかかりは、困難かも知れないが、要点を会得すれば、未知の領域に接する範囲が大きいので、たゆまぬ努力さえ惜しまなければ新製品発見の余地が充分ある。従って根気良く焼成実験の繰り返し作業など手を抜いてはならないしデータの積み重ねを希望する。

時間の関係でCERAMIC CAPACITORの温度依存性の測定確認が出来なかったが、参考文献、EIA規格か、キャパシタハンドブックを参照されて独自にテストして頂きたい。

近年急倹に発展して来た半導体CERAMIC CAPACITORおよび積層 CERAMIC CAPACITOR或は“PIEZO” CERAMICなど今後に取り上げられる研究テーマであろうが、いずれを取組むにせよ、先づ一般用CERAMIC CAPACITORの製造技法の積み重ねにより改善工夫され生み出されたものであるから、基礎を良く理解して将来のテーマをみつけ出してほしい。

次にC.T.R.Lの回路部品研究所で取り上げられている各種類の電子部品は、その何れのものも素材も膜構成が基本となっている。
従って向後基礎知識として結晶粒界、或は境界層および元素配列などの“ミクロ”の勉強が是非とも必要と考える。
何れの研究テーマにおいても関連付けて注意深い視野を望む次第である。

現在のパキスタンを直感時視野でみさせてもらえば、十の力を持つ者をただ十人集めただけでは百の力にしかならないが、これに「いきおい」をつければ二百にも三百にもなる。「静」を「動」に「形」を「勢」に転化させることが重要ではないだろうか？
つまりひとつの目標に向って全員が総力でとり組み達成させる協力心こそ必要な時と感じる。孫子の兵法をあてはめて………。

終わり。

JICA