A-05-05-01

TUSONIX DISC CERAMIC CAPACITORS

Ceramic capacitors, because of their inherent reliability, small size, low cost and wide choice of electrical characteristics available, now outsell all other types combined. TUSONIX manufactures both fixed and variable ceramic capacitors in a broad range of capacitance values, shapes and sizes for the most complete selection in the industry. The most widely used of all are the ceramic disc capacitors which are described in this catalog.

The following pages describe the electrical properties and physical dimensions of TUSONIX's ceramic disc capacitors, capacitance values from 1pF to .06μF and D.C. voltage ratings up to 6000 are included. Within each of the rated voltage classifications a variety of other electrical properties may be selected.

From the standpoint of use, the many ceramic disc capacitors made by TUSONIX can be broadly classified and characterized as follows:

1. **Temperature Compensating** — highest Q, minute capacitance change with temperature, more stable than glass or mica.
2. **Extended Temperature Compensating** — finite and repeatable capacitance change with temperature, also high Q and stability second only to preceding.
3. **High Dielectric Constant** — high capacitance, low dissipation factor replaces paper, film, glass, mica in general purpose applications — biggest seller.

There is considerable overlap in the electrical characteristics of the above categories. This catalog lists the specifications for all significant electrical characteristics so that circuit designers may select the capacitor best suited for each specific application.

TO ORDER:

Specify TUSONIX style number, voltage, TC code, capacitance, tolerance, and any special instructions.

Example:
831-500V-Z5U-1000 pf ±20%
20 AWG outside kink leads,
.187 ± .025'' lead length.

Occasionally, to expedite delivery, TUSONIX will use a more stable Hi-K formulation than ordered.

NOTES:
1. Derate to 67% of rated voltage for +125°C operation.
2. Derate to 60% of rated voltage for +125°C operation.
3. For +85°C operation.

Metric dimensions are designated in this catalog in the following manner:

inches / mm	inches/mm

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APPLICATIONS AND FEATURES

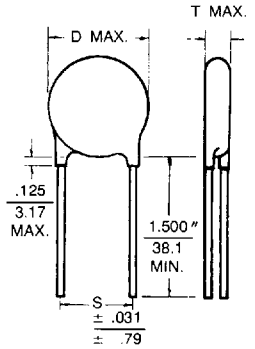
TUSONIX Ceramic Disc Capacitors offer high performance in a complete range of ratings, values and sizes. The complete line of voltage ratings offers the designer the convenience of selecting the exact capacitor rating required for his application. Where voltage rating is not critical, we recommend our standard 500 volt line.

Temperature Compensating Ceramic Capacitors (NPO thru N750) are ideal for applications requiring very precisely controlled capacitance change with temperature, high Q and very small capacitance tolerance.

Extended Temperature Compensating Disc Capacitors (N1500 thru N5600) are capacity sensitive to temperature in varying degrees, and are useful as temperature compensating elements for stabilization over a wide temperature range. They are also widely used in tuning and resonant circuits.

TUSONIX General Purpose or Hi-K Ceramic Disc Capacitors are available in a broad range of dielectric constants. This allows a wide selection of capacitance values.

PHYSICAL CHARACTERISTICS



1. For D, T & S dimensions, see individual charts.
2. See individual charts for standard wire gauge. All values up to and including 2 kV are available with 20, 22 and 24 AWG leads, except body sizes .655" max. and larger available with 20 or 22 AWG only. All values up to and including 6 kV are available with 20 or 22 AWG leads.
3. Body insulation — conformal coating.
4. Standard max. coating on leads is .125"; closer control is optional at extra cost.
5. Marking — Trademark, Cap, Tol., T.C., and Voltage (Voltage omitted on 500V).

SPECIALS

Special disc products are available from TUSONIX upon request. Details on TUSONIX's approval for U.L. line by-pass capacitors and approval to Mil-C-20 and Mil-C-11015 can be found elsewhere in this catalog.

Special physical requirements are also available. This includes the lead types shown on page 13. Special lead spacing requirements are optional upon request, in addition to the standard nominal lead spacings shown in the capacitance charts.

TUSONIX has an excellent background in High Reliability products, and is well known throughout the industry for quality and reliability. TUSONIX's Engineering Department is at your disposal to answer questions and make recommendations concerning any type of special testing and manufacturing required. We are proud of our years of experience and vast accumulation of data, which we encourage you to use.

TUSONIX DISC CERAMIC CAPACITORS

3 and 4kV

TUSONIX STYLE NUMBER	858	878	818	848	828	3848	3858	3878	3888
MAXIMUM DIAMETER (D)	.457/11.61	.510/12.95	.613/15.57	.695/17.65	.770/19.56	.820/20.83	.895/22.73	.957/24.31	1.120/28.45
LEAD SPACING (S)	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52
WIRE GAUGE (AWG)	22	22	22	22	22	20	20	20	20

	TEMP. CHAR. CODE		NOTE *	MIN CAP TOL (%)	MIN TC TOL	MAX DF (%)	MIN Q	3kV — MAXIMUM NOMINAL CAPACITANCE (pF) THICKNESS .187" MAX.								
GENERAL PURPOSE Hi-K	Z5D Y5E X5F X7F			±5		2		100	150	260	360	450	550	680	780	1000
	Z5D Y5E X5F X7R		1	±5		2		370	540	920	1270	1570	1900	2300	2700	3600
	Z5F Y5E X5F X7P		1	±10		2		540	790	1300	1800	2200	2700	3400	3900	5200
	Z5F Y5F X5R X7S		2	±10		2		760	1100	1900	2500	3200	3900	4800	5500	7300
	Z5U Y5U X5U X7V		2	±20		2		900	1300	2200	3000	3800	4600	5700	6500	8700
	Z5U Y5V X5W X7W		2	±20		3		1400	2000	3500	4800	5900	7200	8900	10000	13000
TEMPERATURE COMPENSATING EXTENDED TEMPERATURE COMPENSATING	NP0	C0G	†	±1	±30		1000	1.0-18	27	45	60	75	90	110	130	170
	N030	S1G	1	±1	±30		1000	1.3-9.1	12	20	27	32	41	48	55	75
	N080	U1G	1	±1	±30		1000	1.5-10	14	23	32	38	47	55	65	90
	N150	P2G	1	±1	±30		1000	1.7-12	16	27	36	43	55	60	75	100
	N220	R2G	1	±1	±30		1000	1.9-13	17	29	40	47	60	69	80	110
	N330	S2H	1	±1	±60		1000	2.1-14	19	32	44	53	66	75	90	120
	N470	T2H	2	±1	±60		1000	2.5-22	30	50	65	80	100	110	130	190
	N750	U2J		±2	±120		1000	3.5-35	50	85	110	135	170	200	240	340
	N1500	P3K	1	±2	±250		1000	4.3-41	55	90	120	140	180	210	250	350
	N2200	R3A	2	±2	±400		500	6.9-47	63	100	140	160	210	240	290	400
	N3300	S3B	3	±5	±650		500	12-82	110	180	240	290	370	430	510	700
	N4200	G3C	3. 4	±5	±850		500	21-90	120	200	280	330	410	480	570	790
	N4700	T3D	3. 4	±5	±900		200	110	150	240	330	400	500	580	690	950
	N5600	H3M	3. 4	±5	±1000		200	165	225	370	500	600	750	880	1030	1430

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LEAD SPACING (S)	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52	.375/9.52
WIRE GAUGE (AWG)	22	22	22	22	22	20	20	20	20

	TEMP. CHAR. CODE		NOTE	MIN CAP TOL (%)	MIN TC TOL	MAX DF (%)	MIN Q	4kV — MAXIMUM NOMINAL CAPACITANCE (pF) THICKNESS .218" MAX.								
GENERAL PURPOSE Hi-K	Z5D Y5E X5F X7F			±5		2		80	120	210	290	360	440	540	620	830
	Z5D Y5E X5F X7R		1	±5		2		290	430	730	1000	1200	1500	1800	2100	2800
	Z5F Y5E X5F X7P		1	±10		2		430	620	1000	1400	1800	2200	2700	3100	4100
	Z5F Y5F X5F X7S		2	±10		2		600	880	1500	2000	2500	3100	3800	4300	5800
	Z5U Y5V X5W X7W		2	±20		3		1100	1600	2800	3800	4700	5800	7100	8200	11000
TEMPERATURE COMPENSATING EXTENDED TEMPERATURE COMPENSATING	NP0	C0G		±1	±30		1000	1.0-14	20	35	45	60	75	90	100	140
	N030	S1G	1	±1	±30		1000	1.4-7.1	9 6	16	21	25	32	37	44	60
	N080	U1G	1	±1	±30		1000	1.5-8.3	11	18	25	30	37	44	50	70
	N150	P2G	1	±1	±30		1000	1.8-9.5	12	21	28	34	43	50	59	81
	N220	R2G	1	±1	±30		1000	2.0-10	14	23	31	37	47	55	64	85
	N330	S2H	1	±1	±60		1000	2.2-11	15	25	35	40	50	60	70	100
	N470	T2H	2	±1	±60		1000	2.5-14	18	30	40	50	60	73	85	110
	N750	U2J		±2	±120		1000	3.6-25	40	65	90	105	135	160	195	265
	N1500	P3K	1	±2	±250		1000	6-32	43	70	95	110	140	170	200	270
	N2200	R3A	2	±2	±400		500	7-37	50	80	110	130	160	195	230	310
	N3300	S3B	3	±5	±650		500	12-65	87	140	190	230	290	340	400	550
	N4200	G3C	3. 5	±5	±850		500	13-70	100	160	220	260	330	390	460	630
	N4700	T3D	3. 5	±5	±900		200	10-85	120	190	270	320	400	460	550	760
	N5600	H3M	3. 5	±5	±1000		200	24-130	180	290	400	480	600	700	820	1100

TUSONIX DESIGN SPECIFICATIONS

AGING

All hi-dielectric constant barium titanate based ceramics have a predictable capacitance aging effect. The effect is a loss of capacitance with time. The loss is an inverse logarithmic function and is based on the capacitance value obtained at a given time after the last heat exposure. By the time the user receives the parts, almost all the aging effects are gone, but from time to time it is possible to get "fresh" parts where the aging rate is still taking place fast enough to be noticeable. It's also possible to start the aging over again if the user subjects the part to prolonged temperatures above 100°C (such as during a potting cure cycle; during high temperature environmental tests, etc.).

HiK TEMPERATURE CHARACTERISTICS

EIA Code	Temperature Range
Z5	· 10 C to · 85 C
Y5	30 C to · 85 C
X5	55 C to · 85 C
*X7	55 C to · 125 C

EIA Code	Maximum Cap. Change
D	· 3.3°₀
E	· 4.7°₀
F	· 7.5°₀
P	· 10°₀
R	· 15°₀
S	· 22°₀
T	· 22°₀ 33°₀
U	· 22°₀ 56°₀
V	· 22°₀ 82°₀
W	· 22°₀ 90°₀

*Formerly designated TUSONIX-W5.

TEMPERATURE COEFFICIENTS (Temperature Characteristic)

The TUSONIX catalog lists the various temperature characteristics using standard EIA code symbols. The Hi-K characteristics are treated as maximums and parts supplied as a particular type will drift less than the maximum listed. The T.C. characteristic for temperature compensating types is the nominal capacitance change between 25°C and 85°C in parts per million per degree centigrade. The maximum departure (plus or minus) from this nominal is listed in the catalog for values exceeding 10 pF. The table below shows T.C. tolerances for values below 10 pF.

Temperature Coefficient	Capacitance .4 to 2 pF	2.1 to 3.9 pF	4 thru 9.9 pF
NP0 thru N330	±250(K)	±120(J)	±060(H)
N470 thru N750	±250(K)	±120(J)	±120(J)
N1500 and up	Same as for 10 pF and over		

CAPACITANCE TOLERANCE

Nominal Capacitance 10 pF or Less	Code	Nominal Capacitance over 10 pF and all Resistance Values
	A	· 50 20°₀
±.1 pF	B	
±.25 pF	C	
±.5 pF	D	
±.3 pF	E	· 70 30°₀
±1 pF	F	· 1°₀
±2 pF	G	±2°₀
±3°₀	H	· 3°₀
	I	· 60 40°₀
±5°₀	J	· 5°₀
· 10°₀	K	· 10°₀
±2°₀	L	· 100°₀ 40
±20°₀	M	· 20°₀
· .4 pF	N	±30°₀
	P	· 100 0°₀
±0.2 pF	Q	±15°₀
	R	±2.5°₀
	S	· 50 15°₀
	T	· 30 20°₀
	U	· 80 0°₀
	V	±7.0°₀
	W	· 50 30°₀
	X	· 40 10°₀
	Y	· 50 0°₀
	Z	· 80 20°₀