Disc Ceramic Capacitors

Professional Ceramic Capacitors - Class I, II and III

MIL-STD-202F

The professional ceramic disc capacitors were specially developed for applications in severe environmental conditions, high humidity, temperature, gas, vapor and solvents.

The capacitors are flame retardant epoxy coated, meeting UL 94-V0 flammability specifications. The capacitors are 100% screened on following electrical parameters:

Capacitance, loss factor, test voltage. After the 100% test, the capacitors are audited on its electrical and mechanical parameters with following AQL:

Electrical parameters: 0.065% level II

Mechanical parameters: 0.65% level II

The capacitors withstand the following reliability essays:

Terminal strength: method 211 – condition A

Resistance to solvents: method 215

Resistance to soldering heat: method 210 – condition B

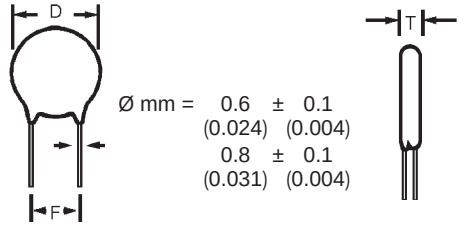
Solderability: method 208

Thermal shock: method 107 – condition A

Humidity (steady state): method 103 – condition D

Life (at elevated ambient temperature): method 108 – condition D

Operating temperature and storage: -55... +125º C



Preferred lead spacing F = 5 (0.197)

millimeters (inches)

Lead Spacing	Digit 8	
F		
2.5 (0.100)	D	—
5 (0.200)	A	O
6 (0.250)	E	X
7.5 (0.300)	B	R
10 (0.400)	C	W

DIMENSIONS

millimeters (inches)

Digit 9 (ø)	D ± 2 (0.079)	T max.	Available Lead Spacing
A NP0 1pF... 2.7 pF	4.0 (0.157)	3.0 (0.118)	A,B,D,E,O,R
A N1500 5.6pF... 8.2 pF	4.0 (0.157)	3.0 (0.118)	A,B,D,E,O,R
A Others	4.0 (0.157)	3.0 (0.118)	A,B,D,E,O,R
B	5.0 (0.197)	3.0 (0.118)	A,B,D,E,O,R,X
C	6.0 (0.236)	3.0 (0.118)	A,B,C,D,E,O,R,X
D	7.0 (0.276)	3.0 (0.118)	A,B,C,D,E,O,R,X
E	8.0 (0.315)	3.0 (0.118)	A,B,C,D,E,O,R,X
F	9.0 (0.354)	3.0 (0.118)	A,B,C,E,O,R,X
G	10.0 (0.394)	3.0 (0.118)	A,B,C,E,O,R,X
H	11.0 (0.433)	3.0 (0.118)	A,B,C,E,O,R,W
J	13.0 (0.512)	3.5 (0.138)	B,C,R,W
K	15.0 (0.591)	3.5 (0.138)	B,C,R,W
M	19.0 (0.748)	4.0 (0.157)	B,C

(E), (X), (W): upon request

Disc Ceramic Capacitors

General Specifications - Class I and II Professional

DIELECTRIC - CLASS I

These ceramic capacitors have linear temperature coefficient, very low tolerances, low losses, high insulation resistance and are specially suitable for tuned circuits, timing and other precision circuits.

100V ... 500V PERFORMANCE CHARACTERISTICS CLASS I

Measured at %	1.0 MHz / 1.0 Vrms / 25ºC
Dissipation Factor	$C_R \leq 30$ pF $\rightarrow \leq 1/C_R + 0.07$ $C_R > 30$ pF $\rightarrow \leq .1\%$
Tolerance	$C_R < 10$ pF $\rightarrow \pm 0.25$ pF, ± 0.5 pF $C_R \geq 10$ pF $\rightarrow \pm 5\%$, $\pm 10\%$
Insulation Resistance	@ $V_R \rightarrow \geq 10$ GΩ

Dielectric Strength NOTE: Charging current limited to 50 mA	$V_R = 100V \rightarrow Vt = 250V$ (DC) $V_R = 500V \rightarrow Vt = 1.25kV$ (DC) Between leads and body insulation
Operating Temperature Range (ºC)	-55... +125 Epoxy Coated
Climatic Category	55 / 085 / 56

Note: Damp Heat Steady State: 90... 95% R.H. 40ºC / 56 days. No voltage to be applied.

DIMENSION TABLE - CLASS I LOW AND MEDIUM VOLTAGE PROFESSIONAL

100V / 500V CLASS I EPOXY COATED – CAPACITANCE VS. DISC DIAMETER

millimeters (inches)

Temp. Coefficient	NP0		N750		N1500	
Digits 1, 2, 3 of P.N.	6AK	6AQ	6GK	6GQ	6HK	6HQ
Rated Voltage	100 VDC	500 VDC	100 VDC	500 VDC	100 VDC	500 VDC
C_R (pF)						
1.0	4.0 (0.157)	4.0 (0.157)	4.0 (0.157)	4.0 (0.157)		
1.2						
1.5						
1.8						
2.0						
2.2						
2.7						
3.0						
3.3						
3.9						
4.0						
4.7						
5.0						
5.6						
6.0					4.0 (0.157)	4.0 (0.157)
6.8						
7.0						
8.0						
8.2						
9.0						
10						
12						
15						
18	5.0 (0.197)	5.0 (0.197)				
20						
22						
27						
33		6.0 (0.236)				
39		7.0 (0.276)	5.0 (0.197)	5.0 (0.197)		5.0 (0.197)
47	7.0 (0.276)				5.0 (0.197)	
50						
56	8.0 (0.315)	8.0 (0.315)		6.0 (0.236)		6.0 (0.236)
68						
82		9.0 (0.354)	6.0 (0.236)	7.0 (0.276)		
100	9.0 (0.354)	11.0 (0.433)	7.0 (0.276)	8.0 (0.315)		7.0 (0.276)
120						
150	11.0 (0.433)			9.0 (0.354)	7.0 (0.276)	8.0 (0.315)
180		15.0 (0.591)	8.0 (0.315)	11.0 (0.433)		
220			9.0 (0.354)			9.0 (0.354)
270		19.0 (0.748)	11.0 (0.433)	13.0 (0.512)	8.0 (0.315)	11.0 (0.433)
330				15.0 (0.591)	9.0 (0.354)	

Diameter (ϕ) = 9th Part Number Digit

Disc Ceramic Capacitors

Ordering Code

HOW TO ORDER

5 | **O** | **Q** | **222**

General Purpose
5A = NP0 / I
*5B = P100 / I
*5C = N150 / I
*5D = N220 / I
*5E = N330 / I
*5F = N470 / I
5G = N750 / I
5H = N1500 / I
*5I = N2200 / I
*5J = N4700 / I
5K = SL
5M = Y5E / II
5N = Y5F / II
5O = Y5P / II
*5P = Y5R / II
*5Q = Y5T / II
5S = Y5U / II
5T = Y5V / II
5U = Z5V / II
*5V = Z4V / III
5W = Y5P / III
5Y = Y5U / III
5Z = Y5V / III

Professional Switch Mode Safety
6A = NP0 / I
*6B = P100 / I
*6C = N150 / I
*6D = N220 / I
*6E = N330 / I
*6F = N470 / I
6G = N750 / I
*6H = N1500 / I
*6I = N2200 / I
6J = N4700 / I
61 = SAFETY
62 = SAFETY
65 = SAFETY
67 = Y5U / SM
68 = Y5V / SM
6L = Y5P / SM
6M = X5E / II
6N = X5F / II
6O = X5P / II
*6P = X5R / II
*6Q = X5T / II
6S = X5U / II
6T = X5V / II
6U = Z5V / II
*6V = Z4V / III
6W = Y5P / III
6Y = Y5U / III
6Z = Y5V / III

Rated Voltage (dc)
D = 16V
F = 25V
H = 50V
K = 100V
N = SAFETY
O = SAFETY
Q = 500V
R = 1000V
S = 2000V
T = 3000V
U = 4000V
V = SAFETY
W = 5000V
*X = 6000V
*Y = 7500V

Capacitance
222 = 2.2 nF

Capacitance = TPC code
1 pF = 1R0
1.2pF = 1R2
1.5pF = 1R5
1.8pF = 1R8
2.2pF = 2R2
2.7pF = 2R7
3.9pF = 3R9
4.7pF = 4R7
5.6pF = 5R6
6.8pF = 6R8
8.2pF = 8R2
10pF = 100
12pF = 120
15pF = 150
18pF = 180
22pF = 220
27pF = 270
33pF = 330
39pF = 390
47pF = 470
56pF = 560
68pF = 680
82pF = 820

Capacitance = TPC code
100pF = 101
120pF = 121
150pF = 151
180pF = 181
220pF = 221
270pF = 271
330pF = 331
390pF = 391
470pF = 471
560pF = 561
680pF = 681
820pF = 821
1nF = 102
1.2nF = 122
1.8nF = 182
2.2nF = 222
2.7nF = 272
3.3nF = 332
3.9nF = 392
4.7nF = 472
5.6nF = 562
6.8nF = 682
8.2nF = 822
10nF = 103
15nF = 153
22nF = 223
33nF = 333
47nF = 473
100nF = 104
200nF = 204

*Upon Request

Disc Ceramic Capacitors

Ordering Code

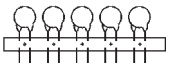
M **A** **E** **A** **A**

Tolerance
C = ±0.25 pF
D = ±0.50 pF
J = ±5%
K = ±10%
M = ±20%
S = -20+50%
Z = -20+80%
P = 0+100%

Capacitor Diameter ± 2 (0.079)
A = 4 (0.157)
B = 5 (0.197)
C = 6 (0.236)
D = 7 (0.276)
E = 8 (0.315)
F = 9 (0.354)
G = 10 (0.394)
H = 11 (0.433)
J = 13 (0.512)
K = 15 (0.591)
M* = 19 (0.748)
*Wire 0.8 (0.031) recommended

Packaging

Cardboard Strips
A =



Bulk
E = 5 (0.197) ± 1 (0.039) free wire length
C = 10 (0.394) ± 1 (0.039) free wire length
D = 25 (0.984) ± 1 (0.039) free wire length

Taping

Reel

Avisert			Panasert		
H	L	L	J	L	L

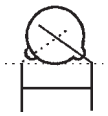
Ammo Pack

Avisert			Panasert		
I	M	M	K	M	M

Lead Forming				
mm	inches			
2.5 ±0.5	.1 ± .025	D	–	–
5 +0.6 -0.2	.2 ± .025	A	O	N
6 +0.6 -0.2	.25 ± .025	E	X	–
7.5 +1 -0.5	.3 ± .05	B	R	Q
10 +0.5 -1.0	.4 ± .05	C	W	–
12.5 +1 -0.5	.5 ± .05	P	–	–

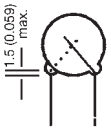
Finishing

Diam ≤9 (0.354) and F = 5.00 (0.197)



Coating does not surpass the bend

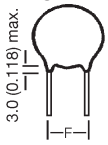
For every other:



Low Voltage

A = Phenolic (General Purpose) Q = Waxed phenolic
S = Epoxy (Professional) cap. diameter ≤ 8 (0.315)
D = Epoxy (Professional) cap. diameter > 8 (0.315)

High Voltage



F = Measured from the center of leads

C = Epoxy wire diameter 0.6 (0.024) ± 0.1 (0.004)
I = Epoxy wire diameter 0.8 (0.031) ± 0.1 (0.004)
L = Phenolic wire diameter 0.6 (0.024) ± 0.1 (0.004)

Please note that not all code combinations are either possible or available.

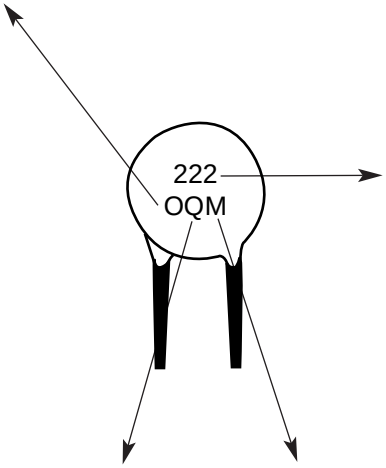
Disc Ceramic Capacitors

Marking

DIG. 2	
O	
TC / Class	
General Purpose	Professional
A = NP0 / I	A = NP0 / I
*B = P100 / I	B = P100 / I
*C = N150 / I	C = N150 / I
*D = N220 / I	D = N220 / I
*E = N330 / I	E = N330 / I
*F = N470 / I	F = N470 / I
G = N750 / I	G = N750 / I
H = N1500 / I	H = N1500 / I
*I = N2200 / I	I = N2200 / I
*J = N4700 / I	J = N4700 / I
K = SL	7 = Y5U / SM
M = Y5E / II	8 = Y5V / SM
N = Y5F / II	L = Y5P / SM
O = Y5P / II	M = X5E / II
P = Y5R / II	N = X5F / II
Q = Y5T / II	O = X5P / II
S = Y5U / II	P = X5R / II
T = Y5V / II	Q = X5T / II
U = Z5V / II	S = X5U / II
V = Z4V / III	T = X5V / II
*W = Y5P / II	U = Z5V / II
*X = Y5R / II	V = Z4V / III
Y = Y5U / II	W = Y5P / III
Z = Y5V / II	X = Y5R / III
	Y = Y5U / III
	Z = Y5V / III

*Upon Request

Logo: Only in diam. ≥ 6mm



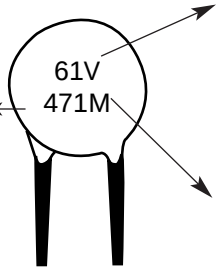
DIG. 3
Q
Rated Voltage
D = 16V
F = 25V
H = 50V
K = 100V
Q = 500V
R = 1000V
S = 2000V
T = 3000V
U = 4000V
W = 5000V
X = 6000V
Y = 7500V

DIG. 7
M
Tolerance
C = ±0.25pF
D = ±0.5pF
J = ±5%
K = ±10%
M = ±20%
S = -20 +50%
Z = -20 +80%
P = 0 +100%

Capacitance	EIA
1pF = 109	100pF = 101
1.2pF = 129	120pF = 121
1.5pF = 159	150pF = 151
1.8pF = 189	180pF = 181
2.2pF = 229	220pF = 221
2.7pF = 279	270pF = 271
3.9pF = 399	390pF = 391
4.7pF = 479	470pF = 471
5.6pF = 569	560pF = 561
6.8pF = 689	680pF = 681
8.2pF = 829	820pF = 821
10pF = 100	1nF = 102
12pF = 120	1.2nF = 122
15pF = 150	1.8nF = 182
18pF = 180	2.2nF = 222
22pF = 220	2.7nF = 272
27pF = 270	3.9nF = 392
39pF = 390	4.7nF = 472
47pF = 470	5.6nF = 562
56pF = 560	6.8nF = 682
68pF = 680	8.2nF = 822
82pF = 820	10nF = 103
	15nF = 153
	22nF = 223
	33nF = 333
	47nF = 473
	100nF = 104
	200nF = 204

Safety Front

Capacitance
As above



Type
61V
620
65N

Tolerance
As above

Back: (Approval marks)

TC – Temperature coefficient.

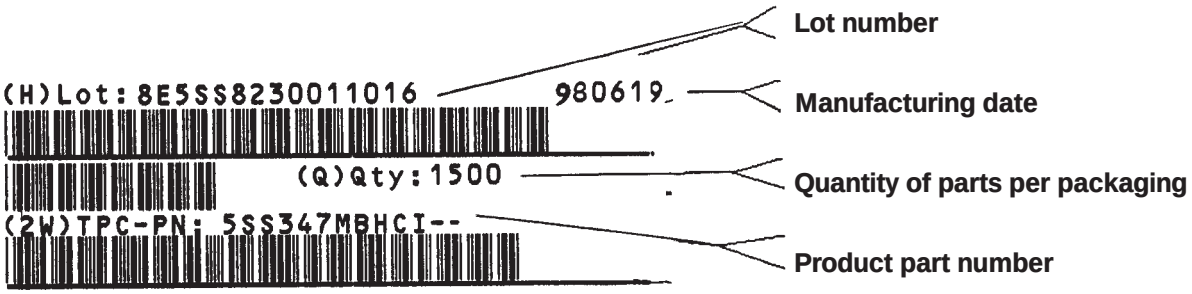
DIG – for better understanding, check pages 3 and 4.

Disc Ceramic Capacitors

Packaging

IDENTIFICATION AND TRACEABILITY

On all TPC ceramic capacitors packages, you will find a bar code label with the following information:



TAPED PARTS QUANTITY TABLE

millimeters (inches)

Rated Voltage	Diameter	Quantities	
(Vr)	D	Ammopack	Reel
Vr <= 500V	D ≦ 7 (0.276)	2000	2500
	7 < D ≦ 11 (0.433)	2000	2000
500V<Vr<=2KV	D ≦ 11 (0.433)	1500	2000
2KV<Vr=5KV	D ≦ 11 (0.433)	1000	1500

CARDBOARD STRIPS QUANTITY TABLE

millimeters (inches)

Rated Voltage	Diameter	Lead Space	
(Vr)	D	< = 5 (0.197)	> 5 (0.197)
Vr <= 500V	D ≦ 8 (0.315)	2500	1500
	8 (0.315) ≦ D≦ 11 (0.433)	1500	-
	8 (0.315) ≦ D≦ 13 (0.512)	-	1000
	11 (0.433) ≦ D≦ 15 (0.591)	1000	-
	13 (0.512) ≦ D≦ 19 (0.748)	-	500
	D ≦ 19 (0.748)	500	-
500V<Vr<=2KV	D ≦ 9 (0.354)	1500	1000
	9 (0.354) ≦ D ≦ 11 (0.433)	-	1000
	9 (0.354) ≦ D ≦ 13 (0.512)	1000	-
	11 (0.433) ≦ D ≦ 19 (0.748)	-	500
	13 (0.512) ≦ D ≦ 19 (0.748)	500	-
2KV<Vr<=5KV	D ≦ 9 (0.354)	1500	-
Safety 65N 62O	D ≦ 11 (0.433)	-	1000
	D ≦ 13 (0.512)	500	500
Safety	D ≦ 6 (0.236)	1500	1500
61V	7 (0.275) ≦ D ≦ 9 (0.354)	1000	1000
	9 (0.354) ≦ D	500	500

Quantities for other package alternative, upon request.

Disc Ceramic Capacitors

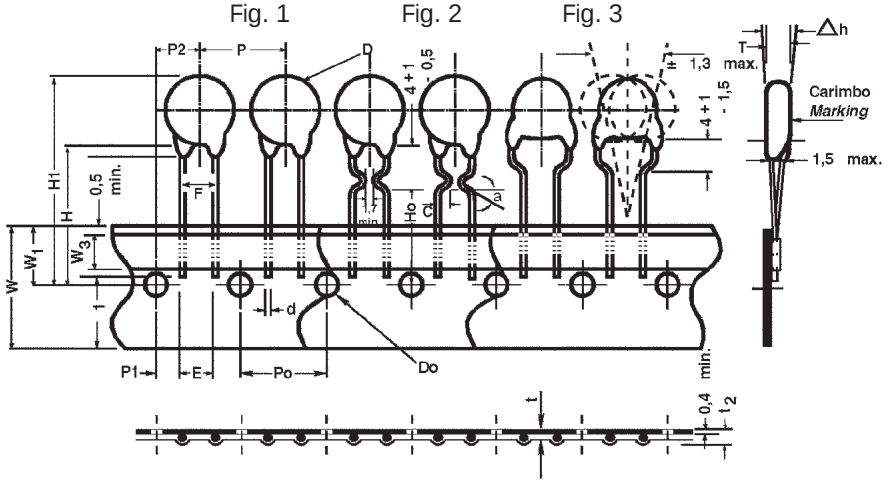
Tape and Reel Specifications

There are two types of taped disc ceramic capacitors:
Straight or crimped leads.

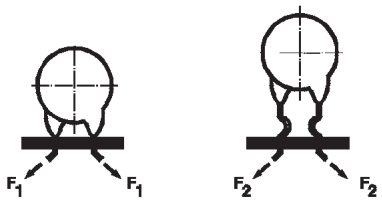
Both types can be shipped on reels or ammopack.
The standard packaging quantities are shown bellow:

millimeters (inches)

Fig. 1 Fig. 2 Fig. 3



Straight leads Crimped leads



Maximum pull force during insertion and lead cut

	F_1	F_2
4 (0.157) ≤ D < 6 (0.236)	12N	20N
D ≥ 6 (0.236)	20N	25N

Digit 11		Available Tapings		Digit 9
L M	→	Sizes	4 (0.157) ≤ D ≤ 11 (0.433)	A... H
J H K I	→	Sizes	6 (0.236) ≤ D ≤ 11 (0.433)	C... H

TPC Code Digit 11

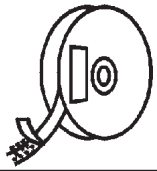
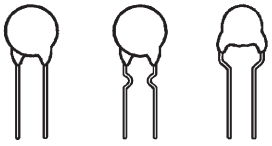
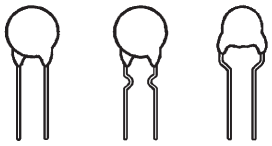
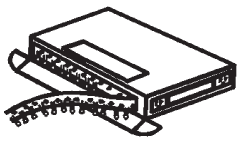
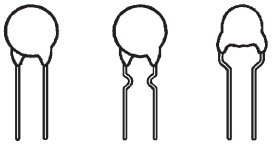
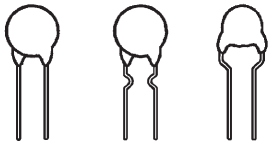
Packaging	Avisert	Panasert
Reel 	 H L L FIGURE 1 FIGURE 2 FIGURE 3	 J L L FIGURE 1 FIGURE 2 FIGURE 3
Ammopack 	 I M M FIGURE 1 FIGURE 2 FIGURE 3	 K M M FIGURE 1 FIGURE 2 FIGURE 3

Figure 2: Inside Crimp 100V... 1000V
Figure 3: Outside Crimp 1000V

Disc Ceramic Capacitors

Tape and Reel Specifications

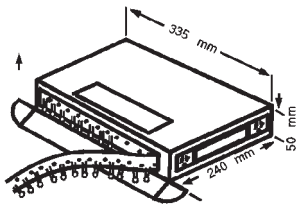
millimeters (inches)

Description of Symbols		Straight Leads		Crimped
		Figure 1		Figure 2 & 3
		A (Avisert)	P (Panasert)	Avisert & Panasert
Crimp angle	∝	—	—	20º...45º
Crimp length	C	—	—	1.7 min.
Lead diameter	d	0.60 ± 0.1		
Disc diameter	D	11 max.		
Lead hole diameter	Do	4.0 ± 0.2		
Disc thickness	T	See Catalog		
Lead spacing	F	$5.0^{+0.6}_{-0.2}$		
Component alignment, front-rear	Δ h	0 ± 1		
Height of component from tape center	H	19.5 ± 0.5	16.5 ± 0.5 - 0	—
Height from tape center to crimp	Ho	—	—	16 + 0.5 - 0
Component height	H1	32.25 max.	>23.5 <32.25	32.25 max.
Distance from component leads to tape bottom	ℓ_1	12 max.		
Tape width	W	$18^{+1}_{-0.5}$		
Bonding tape width	W_3	5.5 min.		
Feed hole position	W_1	9.0 ± 0.5		
Pitch between discs	P	12.7 ± 1		
Feed hole pitch	Po	12.7 ± 0.3		
Hole center to lead	P1	3.85 ± 0.7		
Feed hole center to component center	P2	6.35 ± 1		
Tape + bonding tape thickness	t	0.7 ± 0.2		
Total tape thickness. including lead	t_2	1.5 max.		

PACKAGING

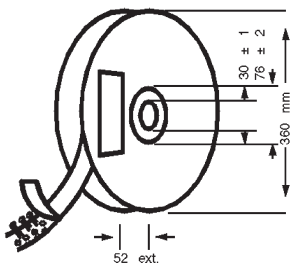
Ammopack

This side up during storage and transportation



max. stacking: 10 boxes

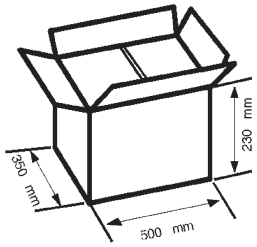
Reel



max. stacking: 10 reels

SHIPPING CONTAINER

8 Ammopack



5 Reel