BREL INTERNATIONAL COMPONENTS
1621 WEST UNIVERSITY PARKWAY SARASOTA, FL 34243
SALES (800) 237-4564
PHONE (941) 355-9791 FAX (941) 355-1530

CERAMIC CAPACITORS

DISC, MULTILAYER & TUBULAR AXIAL LEAD

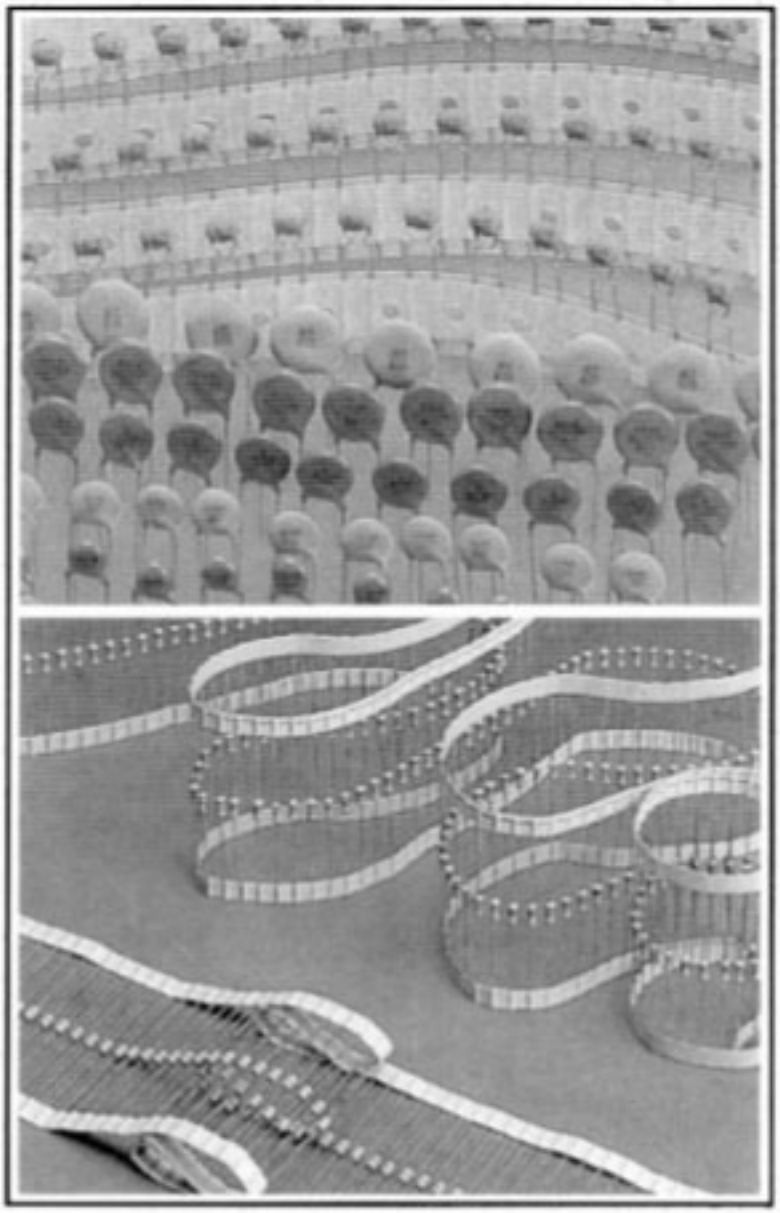

Table of Contents

DISC CAPACITORS

MULTILAYER & TUBULAR AXIAL LEAD CAPACITORS

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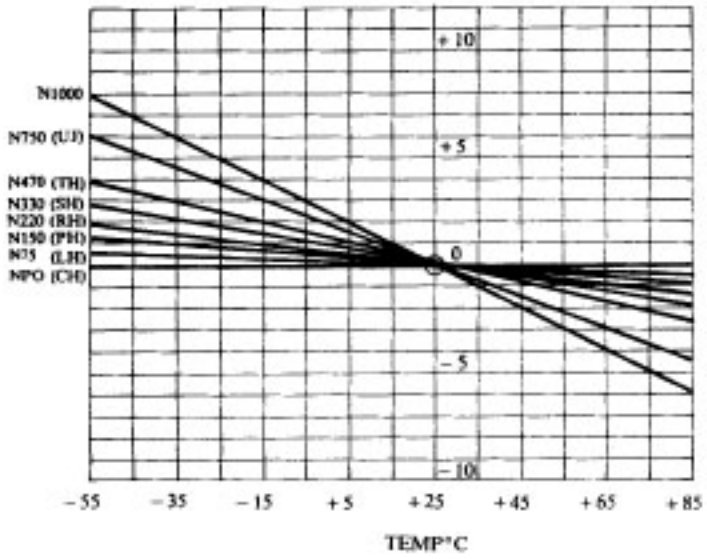
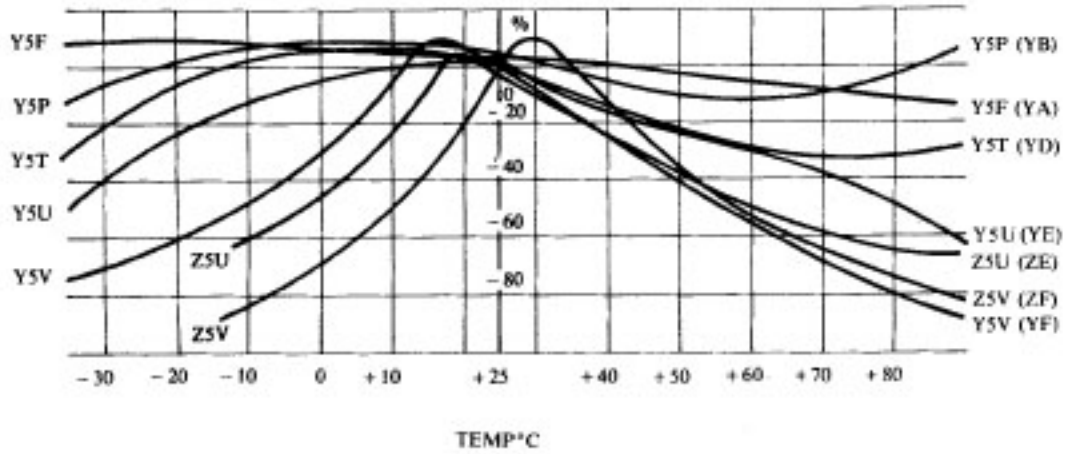
DISC CAPACITORS — CAPACITANCE TOLERANCE

Code	Tolerance Value	Apply T.C.	Remark
C	± 0.25 PF	NPO - N750	For Smaller Than 5 PF
D	± 0.50 PF	NPO - N750	For Smaller Than 5 PF
F	± 1.00 PF	NPO - N750	For Smaller Than 5 PF
J	± 5%	NPO - N1000	For Over 5 PF
K	± 10%	NPO - N1500 Y5F, Y5P	For Over 5 PF
M	± 20%	NPO - N1000 Y5F, Y5P Y5U, Z5U	For Over 5 PF
S	± 50% - 20%	Y5U,Z5U,Z5V	
Z	± 80% - 20%	Y5U,Z5U,Z5V	
P	± 100% - 0	Y5U,Z5U,Z5V	

T.C. Type Capacitance Change Chart By ppm $= \frac{\Delta C}{\text{Cap } 25°C \times T} \times 1{,}000{,}000$



HI-K Type Capacitance Change Chart Change Rate By % $= \frac{\Delta C}{\text{Cap } 25°C} \times 100$



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DISC CAPACITORS — CAPACITANCE RANGE CHART (BY PF)

T.C Type 50V (F) & 500V (L) Rated Voltage

Rated Voltage	Diameter	Temperature Characteristic								Lead Space
	D± ± 1m/m	NPO(CH)	N75(LH)	N150(PH)	N220(RH)	N330(SH)	N470(TH)	N750(UJ)	SL(GP)	m/m
50VDC	4	1 - 24	1 - 12	1 - 24	1 - 27	1 - 27	1 - 33	1 - 43	1 - 82	5
	5	25 - 47	13 - 22	25 - 47	28 - 47	28 - 47	34 - 47	44 - 82	100 - 150	5
	6	50 - 100	24 - 33	50 - 100	50 - 100	50 - 100	83 - 100	83 - 120	180 - 270	5
	8	120 - 180	35 - 68	120 - 180	120 - 180	120 - 180	120 - 180	150 - 270	300 - 560	5
	10	200 - 330	72 - 130	200 - 330	200 - 330	200 - 330	200 - 330	300 - 470	680 - 1,000	5
500VDC	5	1 - 27	1 - 27	1 - 27	1 - 27	1 - 27	1 - 27	1 - 47	1 - 91	5
	6	30 - 56	30 - 56	30 - 56	30 - 56	30 - 56	30 - 56	56 - 82	100 - 180	5
	8	62 - 120	62 - 100	62 - 100	62 - 120	62 - 120	62 - 120	91 - 180	200 - 330	5
	10	150 - 220	150 - 220	150 - 220	150 - 220	150 - 220	150 - 220	200 - 330	390 - 560	5

HI-K Type 50V (F) & 500V (L) Rated Voltage

Rated Voltage	Diameter	Temperature Characteristic				Lead Space
	D± ± 1m/m	Y5F(A)	Y5P(B)	Z5U(E)	Z5V(F)	m/m
50VDC	4	100 - 470	200 - 1,000	1,000 - 2,700	1,000 - 5,000	5
	5	500 - 680	1,200 - 2,200	3,000 - 4,700	5,600 - 8,200	5
	6	820 - 1,000	2,700 - 3,300	5,000 - 10,000	10,000	5
	8	1,200 - 2,700	3,900 - 5,600		22,000 - 33,000	5
500VDC	5	100 - 330	250 - 560	1,000 - 2,200	2,000 - 3,300	5
	6	350 - 560	620 - 1,200	2,700 - 3,900	3,900 - 4,700	5
	8	620 - 1,200	1,500 - 2,200	4,700 - 6,800	5,000 - 8,200	5
	10	1,500 - 2,200	2,700 - 4,700	8,200 - 10,000	10,000 - 15,000	5

T.C. & HI-K Type High Rated Voltage

Rated Voltage	Diameter	Temperature Characteristic			Lead Space
	D± ± 1m/m	SL(GP)	Y5P(B)	Z5U(E)	m/m
1KV	5	10 - 82	100 - 560	1,000	5
	6	100 - 150	680 - 1,000	2,200	5
	8	180 - 270	1,500 - 2,200	3,300 - 4,700	5
	10	330 - 470	2,700 - 3,300	10,000	5
	12		4,700		7.5
2KV	6	10 - 68	100 - 470	1,000	7.5
	8	82 - 150	680 - 1,000	2,200	7.5
	10	180 - 220	1,200 - 2,200	4,700	7.5
	12	270 - 390	3,300		7.5
	14	470 - 560			7.5
	16		4,700	10,000	7.5
3KV	6	10 - 39	100 - 330		10
	8	47 - 82	470 - 680	1,000	10
	10	100 - 120	1,000	2,200	10
	12	150 - 220	1,500		10
	14	270	2,200	4,700	10
	16	330 - 390	3,300		10

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DISC CAPACITORS — CAPACITANCE RANGE CHART (BY UF)

16V S.C. Type Rated Voltage

Diameter	Temperature Characteristic			
D± 1m/m	Y5R	Y5T	Y5U	Y5V
5	.001 – .022	.01 – .033	.01 – .056	.01 – .1
6	.027 – .047	.047 – .1	.068 – .1	
8	.056 – .1			

25V S.C. Type Rated Voltage

Diameter	Temperature Characteristic			
D± 1m/m	Y5R	Y5T	Y5U	Y5V
5	.001 – .022	.01 – .022	.01 – .056	.01 – .047
6	.027 – .047	.033 – .056	.068 – .1	.068 – .1
8	.056 – .1	.068 – .1		
10				

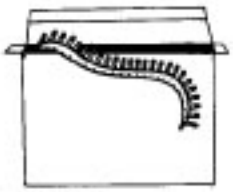
50V S.C. Type Rated Voltage

Diameter	Temperature Characteristic			
D± 1m/m	Y5R	Y5T	Y5U	Y5V
5		.01 – .022	.01 – .033	.01 – .047
6		.033 – .047	.047 – .056	
8			.068 – .1	.056 – .1
10		.056 – .1		

DISC CAPACITORS — PACKING INFORMATION

AMMO PACKING

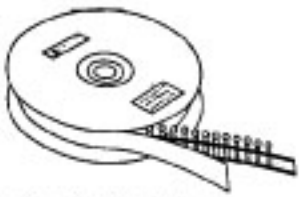
(Tape/Box)



Capacitor Quantity:
2,000 pcs per box

Unit: mm

TAPED & REFILL



Capacitor Quantity:
2,000 or 2,500 per reel

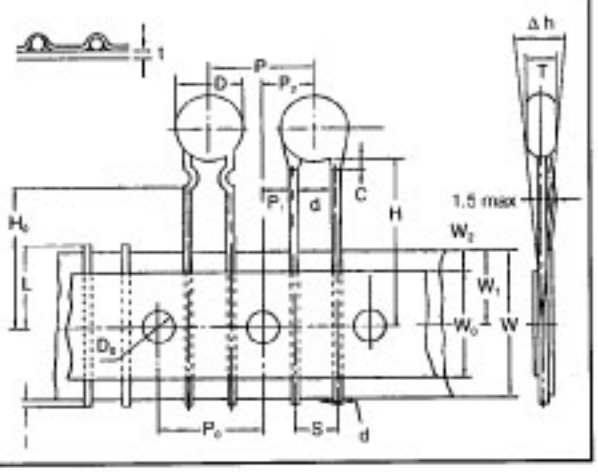
Unit: mm

TAPED SPECIFICATIONS

DIMENSIONS

Item	Symbol	Specifications	Remarks
Body diameter	D	10.00	max.
Body thickness	T	3.50	max.
Lead-wire Diameter	d	0.55	±0.05
Pitch of Component	P	12.70	±1.00
Feed hole pitch	P_0	12.70	±0.50 Cumulative pitch error: 2.0mm/20 pitch
Feed hole center to lead	P_2	3.85	±0.50
Hole center to component center	P_1	6.35	±1.30
Lead-to-lead distance	S	5.00	±0.80
Component alignment, F-R	Δh	0.00	±2.00
Ground paper width	W	18.50	±0.50
Hold-down tape width	W_0	6.00	min.
Hole position	W_1	9.00	±0.50
Hold-down tape position	W_2	3.00	max.
Height of component from tape center	H	20.00	±1.00 For straight lead
Height of component from tape center	H_0	16.00	±1.00 For kink lead
Lead-wire protrusion	l	2.00	max.
Feed hole diameter	D_0	4.00	±0.30
Total Tape Thickness	t	0.70	±0.20 Ground paper: 0.5 ± 0.1 mm
Length of snipped lead	L	11.00	max.
Coating rundown on leads	C	2.00	max.

Unit: mm



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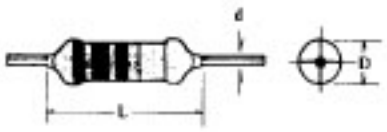
MULTILAYER & TUBULAR AXIAL LEAD CAPACITORS — ORDERING INFORMATION

Size & Dimensions

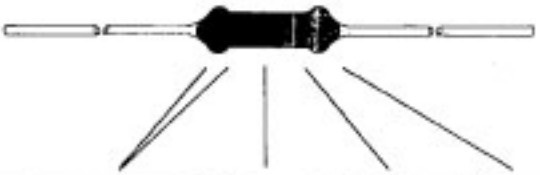
Type	Length(L)max		Diameter(D)max		Lead Wire(d)	
	Inch	mm	Inch	mm	Inch	mm
1510	.15	3.80	.10	2.50	.02	.50
2211	.22	5.50	.11	2.80	.02	.50
2811	.28	7.10	.11	2.80	.024	.60

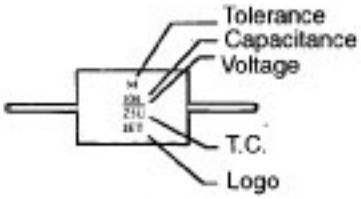


Part Numbering System

Tubular Type	Multilayer Type	Temperature Characteristics		Norminal Capacitance	Tolerance
AD1510	AME1510	NPO	X7R	100-10PF	J±5%
AE1510	AMF1510	N220	Y5P	101-100PF	K±10%
AF1510	AME2211	N750	Y5R	102-1,000PF	M±20%
AD2811	AMF2211	SL	Y5S	103-10,000PF	N±30%
AE2811			Y5V	104-100,000PF	Z±80%-20%
AF2811			Z5U		

Color Code / Marking





Color	1st,2nd Band	Multiplier	Tolerance	Characteristics
Black	0	1	±20%(M)	NPO
Brown	1	10		Y5S
Red	2	100		
Orange	3	1K		
Yellow	4	10K		N220
Green	5			
Blue	6			
Violet	7			N750
Grey	8		±30%(N)	Y5R
White	9		+80-20%(Z)	SL(GP)
Gold	–	0.10	±5%(J)	
Silver	–	0.01	±10%(K)	Y5P

METHOD OF TESTING

Class I (T.C. Type)

Capacitance
Test Frequency:

1MHZ ± 100KHZ For ≤ 1000PF. at 25° ± 2° C
1KHZ + 100HZ For > 1000PF. at 25° ± 2° C

Test Voltage: Shall not exceed 5 Vrms. Max.

Quality Factor (Q)
For NPO to SL When Cap. ≤30PF Q≥ 400+20xCap.
Cap.>30PF Q>1000.
For Cap above 1000PF at KHZ D.F.: 0.2% Max.

Insulation Resistance
10000 MΩ Min, shall be measured 1 minute after with rated voltage.

Dielectric Withstanding Voltage
Capacitors shall withstand, for not less than 5 seconds, a D.C, test voltage of 2.5 times rated working voltage.

Class II (HI-K Type)

Capacitance
Test Frequency: 1KHZ ± 100HZ at 25° ± 2°C
Test Voltage : 5Vrms Max. at 25° ± 2°C

Dissipation Factor (D.F.)
The D.F. shall not be greater than 2.5%.

Insulation Resistance
10,000 MΩ Min, shall be measured 1 minute after with rated voltage.

Dielectric Withstanding Voltage
Capacitors shall withstand, for no less than 1 second, a D.C. test voltage of 2.5 times rated working voltage.

Class III (S.C. Type)

Capacitance
Test Frequency: 1KHZ ± 100HZ at 25°C ± 2°C
Test Voltage : Not Greater than 0.1 Vrms.

Dissipation Factor
At 3 VDC shall not exceed 5%, Above 3 VDC shall not exceed 8%

Insulation Resistance
1,000 MΩ Min, Shall be measured 1 minute after with rated voltage.

Dielectric Withstanding Voltage
Capacitors shall withstand, for not less than 5 seconds, a D.C. test voltage of 2 times rated working voltage

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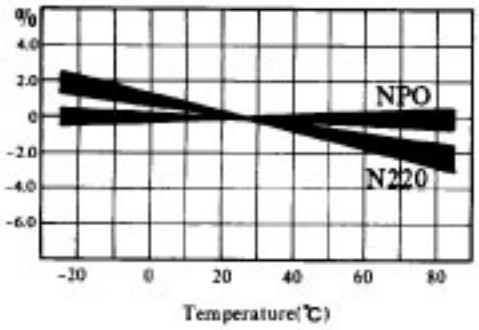
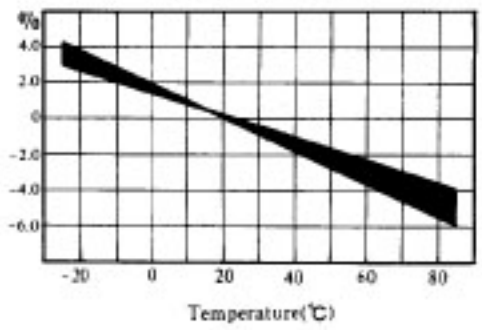
TUBULAR AXIAL LEAD CAPACITORS — TEMPERATURE COEFFICIENT CHARACTERISTICS

Class I (T.C. Type)

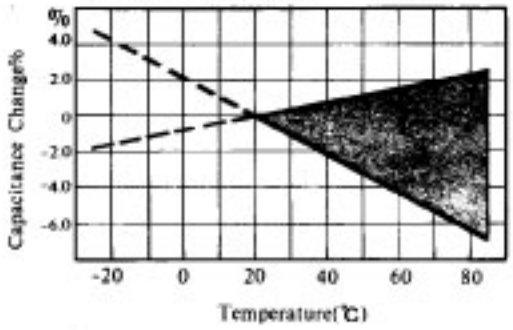
NPO ±60ppm
N220 ±60ppm



N750 ±120ppm

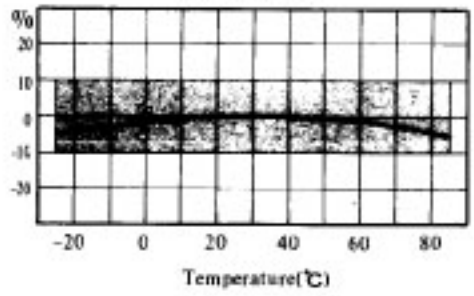


SL(GP): +350ppm ~ -1000ppm

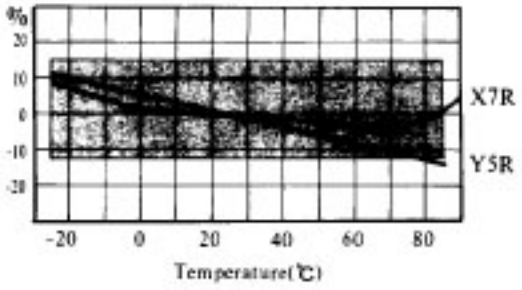


Class II & Class III (HI-K & S.C. Type)

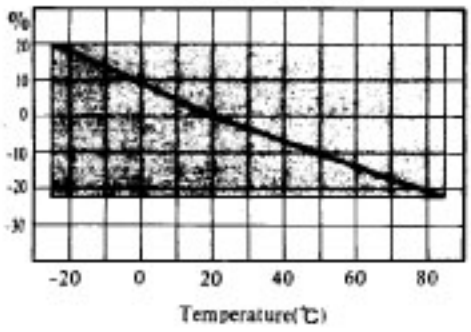
Y5P: ±10%



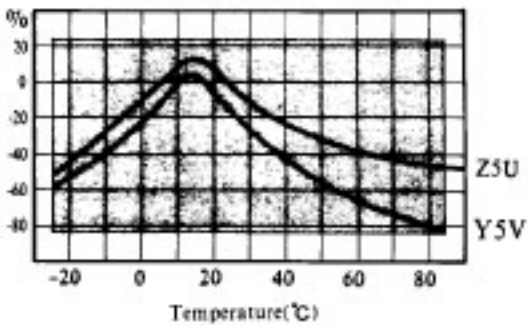
X7R/Y5R(SR): ±15%



Y5S(SS): ±20%



Z5U: +22% ~ -56%
Y5V(SF): +22% ~ -82%



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TUBULAR AXIAL LEAD CAPACITORS — CAPACITANCE RANGE CHART

50V (F) Rated Voltage

Part Number				Normal Capacitance (PF)
1510 TYPE	T.C.	2811 TYPE	T.C.	
AF1510□1R0M	NPO N220 N750 SL(GP)	AF2811□1R0M	NPO N220 N750 SL(GP)	1.0
AF1510□1R2M		AF2811□1R2M		1.2
AF1510□1R5M		AF2811□1R5M		1.5
AF1510□1R8M		AF2811□1R8M		1.8
AF1510□2R2K		AF2811□2R2K		2.2
AF1510□2R7K		AF2811□2R7K		2.7
AF1510□3R3K		AF2811□3R3K		3.3
AF1510□3R9K		AF2811□3R9K		3.9
AF1510□4R7K		AF2811□4R7K		4.7
AF1510□5R6K		AF2811□5R6K		5.6
AF1510□6R8K		AF2811□6R8K		6.8
AF1510□8R2K		AF2811□8R2K		8.2
AF1510□100J		AF2811□100J		10
AF1510□110J		AF2811□110J		11
AF1510□120J		AF2811□120J		12
AF1510□130J		AF2811□130J		13
AF1510□150J		AF2811□150J		15
AF1510□160J		AF2811□160J		16
AF1510□180J		AF2811□180J		18
AF1510□200J		AF2811□200J		20
AF1510□220J	N750 SL(GP)	AF2811□220J		22
AF1510□240J		AF2811□240J		24
AF1510□270J		AF2811□270J		27
AF1510□300J		AF2811□300J		30
AF1510□330J	SL(GP)	AF2811□330J		33
AF1510□360J		AF2811□360J		36
AF1510□390J		AF2811□390J		39
AF1510□430J		AF2811□430J		43
AF1510□470J		AF2811□470J		47
AF1510□510J		AF2811□510J	N750 SL(GP)	51
AF1510□560J		AF2811□560J		56
AF1510□620J		AF2811□620J		62
AF1510□680J		AF2811□680J		68
		AF2811□750J	SL(GP)	75
		AF2811□820J		82
		AF2811□910J		91
		AF2811□101J		100
		AF2811□121J		120

25V (E) Rated Voltage

Part Number				Normal Capacitance (PF)
1510 TYPE	T.C.	2811 TYPE	T.C.	
AE1510□103Z	Y5V	AE2811□682M	Y5R	6,800
		AE2811□103M		10,000
		AE2811□153M		15,000
AE1510□223Z				22,000

50V (F) Rated Voltage

Part Number				Normal Capacitance (PF)
1510 TYPE	T.C.	2811 TYPE	T.C.	
AF1510□820K	Y5P		Y5P	82
AF1510□101K				100
AF1510□121K				120
AF1510□151K		AF2811□151K		150
AF1510□181K		AF2811□181K		180
AF1510□221K		AF2811□221K		220
AF1510□271K		AF2811□271K		270
AF1510□331K		AF2811□331K		330
AF1510□391K		AF2811□391K		390
AF1510□471K		AF2811□471K		470
AF1510□561K		AF2811□561K		560
AF1510□681K		AF2811□681K		680
AF1510□821K	Y5P (SB)	AF2811□821K		820
AF1510□102K		AF2811□102K		1,000
		AF2811□122M	Y5R (SR)	1,200
		AF2811□152M		1,500
		AF2811□182M		1,800
		AF2811□222M		2,200
		AF2811□272M		2,700
		AF2811□332M		3,300
		AF2811□392M		3,900
		AF2811□472M		4,700
		AF2811□562M		5,600
		AF2811□103Z	Y5V (SF)	10,000
		AF2811□223Z		22,000
		AF2811□473Z		47,000

16V (D) Rated Voltage

Part Number				Normal Capacitance (PF)
1510 TYPE	T.C.	2811 TYPE	T.C.	
AD1510□122M	Y5R (SR)			1,200
AD1510□152M				1,500
AD1510□182M				1,800
AD1510□222M				2,200
AD1510□272M				2,700
AD1510□332M				3,300
AD1510□392M				3,900
AD1510□472M				4,700
AD1510□562M				5,600
AD1510□682M				6,800
AD1510□103N	Y5S (SD)	AD2811□223N	Y5S (SD)	22,000

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MULTILAYER AXIAL LEAD CAPACITORS — CAPACITANCE RANGE CHART

50V (F) Rated Voltage

Part Number		Normal Capacitance (PF)
1510 TYPE	T.C.	
AMF1510□1R0M	NPO SL	1.0
AMF1510□1R2C		1.2
AMF1510□1R5C		1.5
AMF1510□1R8C		1.8
AMF1510□2R2C		2.2
AMF1510□2R7C		2.7
AMF1510□3R3C		3.3
AMF1510□3R9C		3.9
AMF1510□4R7C		4.7
AMF1510□5R6J		5.6
AMF1510□6R8J		6.8
AMF1510□8R2J		8.2
AMF1510□100J		10
AMF1510□120J		12
AMF1510□150J		15
AMF1510□180J		18
AMF1510□200J		20
AMF1510□220J		22
AMF1510□240J		24
AMF1510□270J		27
AMF1510□300J		30
AMF1510□330J		33
AMF1510□360J		36
AMF1510□390J		39
AMF1510□470J		47
AMF1510□560J		56
AMF1510□620J		62
AMF1510□680J		68
AMF1510□750J		75
AMF1510□820J		82
AMF1510□910J		91
AMF1510□101J		100
AMF1510□121J		120
AMF1510□151J		150
AMF1510□181J		180

Part Number		Normal Capacitance (PF)
1510 TYPE	T.C.	
AMF1510□221J(K)	NPO SL X7R	220
AMF1510□271J(K)		270
AMF1510□331J(K)		330
AMF1510□391J(K)		390
AMF1510□471J(K)		470
AMF1510□561J(K)		560
AMF1510□681J(K)		680
AMF1510□821J(K)		820
AMF1510□102J(K)		1,000
AMF1510□122J(K)	SL X7R	1,200
AMF1510□152J(K)		1,500
AMF1510□182J(K)		1,800
AMF1510□222J(K)		2,200
AMF1510□272J(K)		2,700
AMF1510□332K(M)	X7R Z5U	3,300
AMF1510□392K(M)		3,900
AMF1510□472K(M)		4,700
AMF1510□562K(M)		5,600
AMF1510□682K(M)		6,800
AMF1510□103K(M)		10,000
AMF1510□153K(M)		15,000
AMF1510□183K(M)		18,000
AMF1510□223K(M)		22,000
AMF1510□273K(M)		27,000
AMF1510□333K(M)		33,000
AMF1510□393K(M)		39,000
AMF1510□473K(M)	Z5U Y5V	47,000
AMF1510□563M(Z)		56,000
AMF1510□683M(Z)		68,000
AMF1510□104M(Z)		100,000

50V (F) Rated Voltage

2211TYPE	T.C.	(PF)
AMF2211□122J	NPO	1,200
AMF2211□152J		1,500
AMF2211□182J		1,800
AMF2211□222J		2,200
AMF2211□272J		2,700
AMF2211□332J	SL	3,300
AMF2211□392J		3,900
AMF2211□472J		4,700
AMF2211□562J		5,600

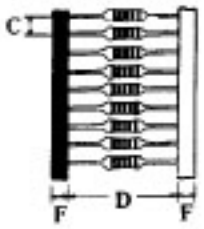
2211TYPE	T.C.	(PF)
AMF2211□563K	X7R	56,000
AMF2211□683K		68,000
AMF2211□104K		100,000
AMF2211□154M(Z)	Z5U Y5V	150,000
AMF2211□224M(Z)		220,000
AMF2211□334M(Z)		330,000
AMF2211□474M(Z)		470,000

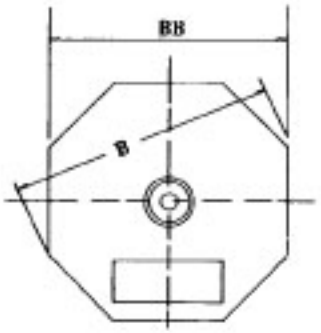
BREL INTERNATIONAL COMPONENTS
1621 WEST UNIVERSITY PARKWAY, SARASOTA, FL 34243
SALES: (800) 237-4564 PHONE: (941) 355-9791 FAX: (941) 355-1530

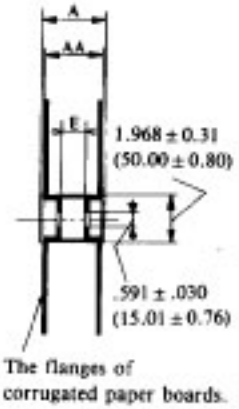
AXIAL LEAD CAPACITORS — PACKING INFORMATION

Taped & Reel Type Dimensions inch (mm)

Across Hubs	Across Flanges	Across Points	Across Flats	Capacitor Spacing		Tape Spacing	Between Hub Holes	Tape Width
				1 Space	50 Spaces			
A Max.	AA Approx.	B Max.	BB Max.	C ±012 (±0.30)	REF 50SC ±.079 (±2.00)	D ±0.39 (±1.00)	E Approx.	F ±.039 (±1.00)
3.209 (81.50)	3.150 (80.00)	13.500 (342.90)	12.402 (315.00)	.197 (5.00)	9.842 (250.00)	2.047 (52.00)	2.165 (55.00)	.236 (6.00)

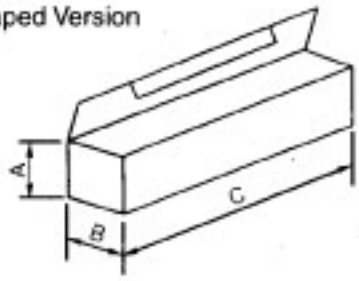






Ammo Taped Type Dimensions

Box for
Taped Version



Dimensions

Symbol	Tapping Width in (mm)	
	1.02(26)	2.05(52)
A	2.16(55±3)	2.16(55±3)
B	2.00(50±3)	2.76(70±3)
C	10.0(255±3)	10.0(255±3)

Standard Packing Quantity

Type \ Packing Style	Taped on Reed	Taped in Box	Bulk
1510 Type	5,000 pcs	4,000 pcs	1,000 pcs
2211 Type	5,000 pcs	2,000 pcs	500 pcs
2811 Type	5,000 pcs	2,000 pcs	500 pcs