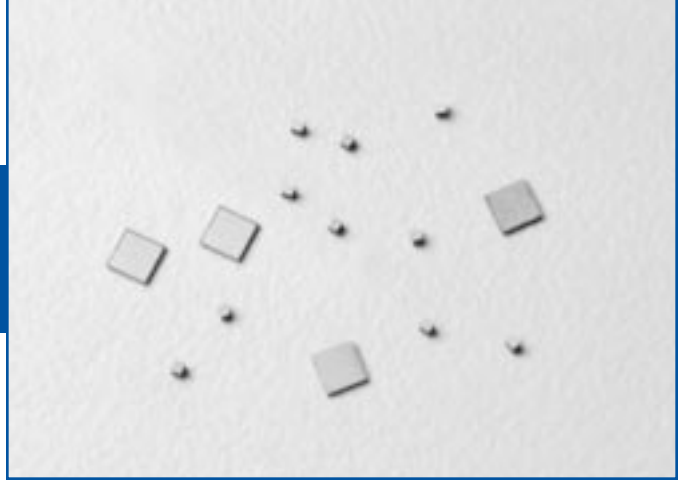
SPECTRUM CONTROL INC.

Single Layer Chip Capacitors



- Electrostatic Discharge (ESD) proof
- Available from .05 pF - 5,000 pF
- Standard voltage range of 50-100 VDC
- Excellent for broadband and microwave applications
- Custom sizes, values, shapes, tolerances and highest voltages available at commercial costs
- Operating frequency up to 50 GHz
- Suitable for DC blocking, tuning and filtering

Specifications

Mechanical Specifications

Hermeticity ..... The dielectric is impervious to moisture and cleaning solvents

Shock and Vibration ..... Exceeds the requirements of MIL-C-55681

Dimensions ..... See table on page 5

Terminations ..... Surface Mount

T1 - For solder, conductive epoxy applications, sputtered on titanium (Ti), tungsten (W), nickel (Ni) with 14 u", gold (Au)

T2 - For most lead bonding applications, sputtered on titanium (Ti), tungsten (W), nickel (Ni) with 100 u" gold electroplate

T3 - For lead bonding with wire sizes of less than 1 mil - sputtered on titanium (Ti), tingsten (W), nickel (Ni) with 150 u" gold electroplate

Note: Gold finish on T1, T2 and T3 meets MIL-G-45204B/2, Type III, Grade A and Type 1, Grade A

Value Added Termination .....
- Single lead beam
- Axial lead beams
- Radial lead beams

- Standard lead material silver (Ag)
- Gold (Au) available upon request
- Typical dimensions
  - Lead thickness - 0.002 inch
  - Lead length is greater than 50% of chip width

Packaging ..... Waffle pack (400 capacitor per pack max.)

Electrical Specifications

Operating Frequency ..... to 50 GHz

Capacitance ..... ≤ 1,000 pF @ 1 MHz, 25°C
> 1,000 pF @ 1 KHz, 25°C

Capacitance Range ..... .05 pF to 5,000 pF

Temperature Characteristics ...

NPO 0 ± 30 ppm	P90 ± 20 ppm
N080 ± 40 ppm	N2400 ± 400 ppm
N150 ± 40 ppm	N3300 ± 600 ppm
N220 ± 50 ppm	N4700 ± 900 ppm
N330 ± 50 ppm	N5600 ± 1,000 ppm
N470 ± 60 ppm	± 15%
N750 ± 100 ppm	+22%/-56%
N1400 ± 250 ppm	

Operating Temperature Range ..... -55°C to +125°C

Working Voltage (WVDC) ..... 50 VDC to 100 VDC
Higher voltages available upon request

Capacitance Tolerance .....

±.01 pF	±1%
±.05 pF	±2%
±.10 pF	±5%
±.25 pF	±10%
±.50 pF	±20%
	+80%/-20%

Insulation Resistance .....

NPO	> 10^6 Megohms at 25°C > 10^5 Megohms at 125°C
X7R, Z5U	> 10^5 Megohms at 25°C > 10^4 Megohms at 125°C

Equivalent Series Resistance ..... > .01 ohms at 1 GHz

Dielectric Strength ..... 250% of WVDC

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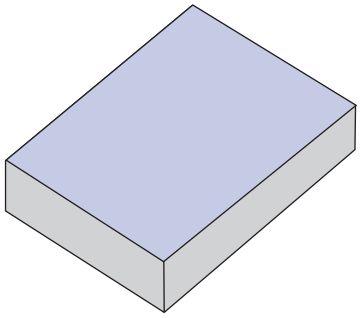
SPECTRUM CONTROL INC.

Single Layer Chip Capacitors

Lead Configurations

Termination Code T1, T2, or T3



Ceramic Dielectric

Surface Mount

T1 - For solder, conductive epoxy applications, sputtered on titanium (Ti), tungsten (W), nickel (Ni), with 14 u" gold (Au)

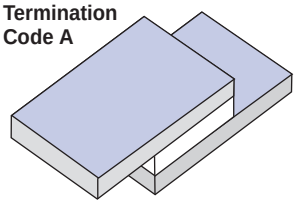
T2 - For most lead bonding applications, sputtered on titanium (Ti), tungsten (W), nickel (Ni) with 100 u" gold electroplate

T3 - For lead bonding with wire sizes of less than 1 mil - sputtered on titanium (Ti), tungsten (W), nickel (Ni) with 150 u" gold electroplate

Note: Gold finish on T1, T2 and T3 meets MIL-G-45204B/2, Type III, Grade A and Type 1, Grade A

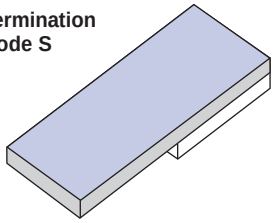
Value Added Termination

Termination Code A



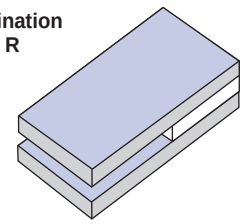
Axial Leads

Termination Code S



Single Lead

Termination Code R



Radial Leads

Standard lead material
Silver (Ag)

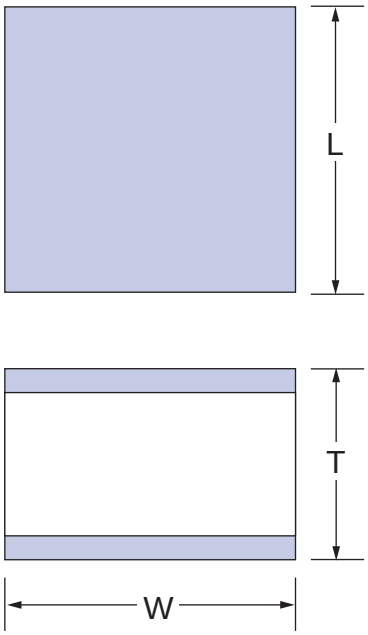
Gold (Au) available upon request

Typical dimensions:

Lead thickness - 0.002 inch

Lead length is greater than 50% of chip width

Body Dimensions



Case Size	Dimensions in inches (mm) Length Max L	Width W	Thickness T 50 Volts	Thickness T 100 Volts
SP100	.010 (.254)	.010 +.000/-.003 (.254 +.000/-.076)	.004 ± .001 (.102 ± .025)	N/A
SP120	.015 (.381)	.012 +.002/-.003 (.305 +.000/-.076)	.004 ± .001 (.102 ± .025)	N/A
SP150	.020 (.508)	.015 +.000/-.003 (.381 +.000/-.076)	.004 ± .001 (.102 ± .025)	.006 ± .001 (.152 ± .025)
SP200	.020 (.508)	.020 +.000/-.003 (.508 +.000/-.076)	.004 ± .001 (.102 ± .025)	.006 ± .001 (.152 ± .025)
SP250	.030 (.762)	.025 +.000/-.003 (.635 +.000/-.076)	.004 ± .001 (.102 ± .025)	.006 ± .001 (.152 ± .025)
SP300	.030 (.762)	.030 +.000/-.003 (.762 +.000/-.076)	.004 ± .001 (.102 ± .025)	.006 ± .001 (.152 ± .025)
SP350	.040 (1.016)	.035 ± .005 (.889 ± .127)	.004 ± .001 (.102 ± .025)	.007 ± .002 (.178 ± .051)
SP500	.060 (1.524)	.050 ± .010 (1.270 ± .254)	N/A	.007 ± .002 (.178 ± .051)
SP700	.080 (2.032)	.070 ± .010 (1.778 ± .254)	N/A	.008 ± .002 (.203 ± .051)
SP900	.100 (2.540)	.090 ± .010 (2.286 ± .254)	N/A	.010 ± .004 (.254 ± .102)
SP910	.200 (5.076)	.175 ± .025 (4.442 ± .635)	N/A	.010 ± .004 (.254 ± .102)

Single Layer Chip Capacitors

Capacitance Values as a Function of Dielectric Material and Case Size

(Values in pF)

50 volts

Case Size		Dielectric Material*						
		C	V	W	X	Y	B	F
SP100	Min.	0.05	0.4	0.85	1.6	3.0	1.8	15
	Max.	0.35	0.8	1.5	3.9	3.9	12	51
SP120	Min.	0.05	0.7	1.6	3.0	6.2	2.2	24
	Max.	0.65	1.5	2.7	5.6	8.2	22	91
SP150	Min.	0.05	1.1	2.4	4.7	10	2.7	43
	Max.	1.0	2.2	4.3	9.1	12	39	150
SP200	Min.	0.1	1.5	3.6	6.2	15	3.6	56
	Max.	1.4	3.3	5.6	12	18	51	200
SP250	Min.	0.2	3.0	7.5	15	24	10	120
	Max.	2.7	6.8	12	22	33	100	390
SP300	Min.	0.3	3.6	9.1	18	30	12	120
	Max.	3.3	8.2	15	27	43	100	470
SP350	Min.	0.4	6.2	15	27	56	20	220
	Max.	5.6	12	24	51	75	200	1,000

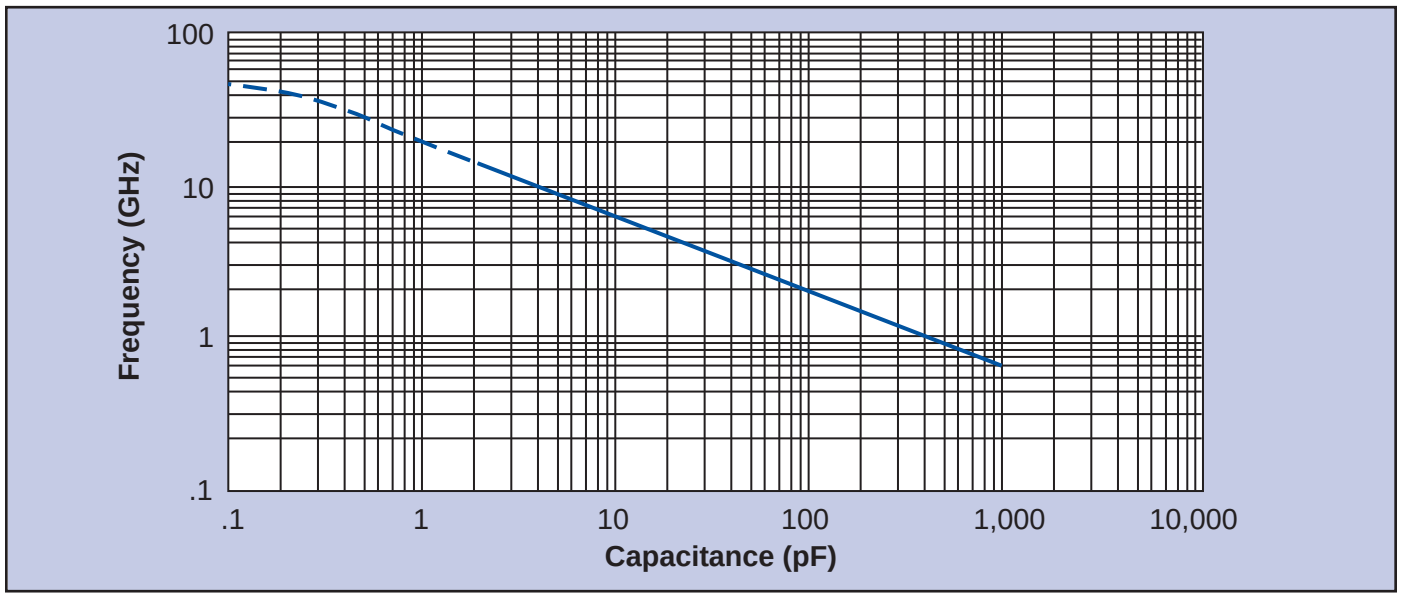
* Refer to page 7 for description of dielectric material by code.

100 volts

Case Size		Dielectric Material*						
		C	V	W	X	Y	B	F
SP150	Min.	0.06	0.75	1.6	3.6	7.5	1.8	30
	Max.	0.7	1.5	3.3	6.8	10	27	100
SP200	Min.	0.06	0.95	2.4	4.3	9.1	2.7	36
	Max.	0.9	2.2	3.9	8.2	12	33	150
SP250	Min.	0.1	1.9	4.2	9.1	18	6.8	75
	Max.	1.8	3.9	8.2	15	22	68	270
SP300	Min.	0.2	2.4	5.1	12	22	8.2	91
	Max.	2.2	4.7	10	20	27	82	390
SP350	Min.	0.3	4.3	9.1	20	43	10	180
	Max.	3.9	8.2	18	39	51	150	560
SP500	Min.	0.8	10	22	43	82	18	360
	Max.	9.1	20	39	75	100	330	1,500
SP700	Min.	1.5	18	36	62	150	39	560
	Max.	15	33	56	120	200	510	2,000
SP900	Min.	2.7	24	56	120	220	47	820
	Max.	22	51	100	200	270	750	3,000
SP910	Min.	5.3	33	105	235	310	55	1,000
	Max.	53	70	220	400	450	975	5,000

Series Resonance

(Capacitance as a Function of Frequency)



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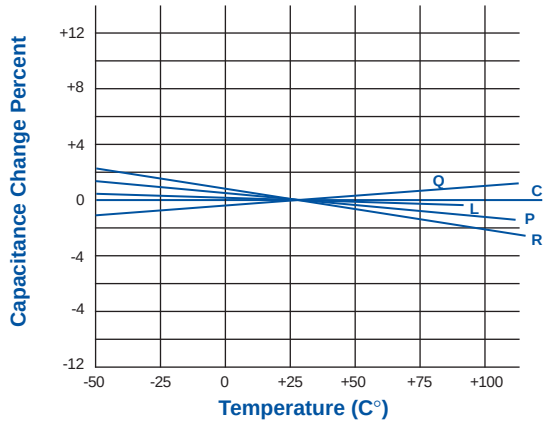
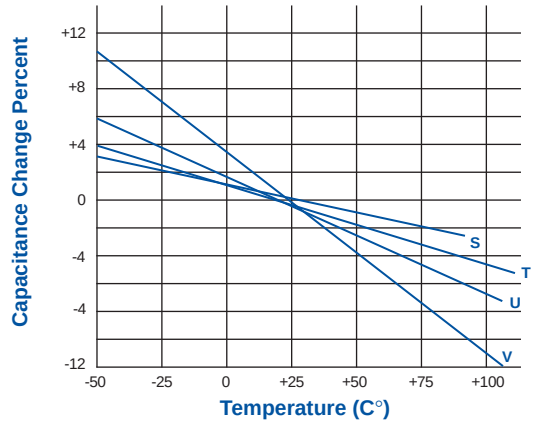
Single Layer Chip Capacitors

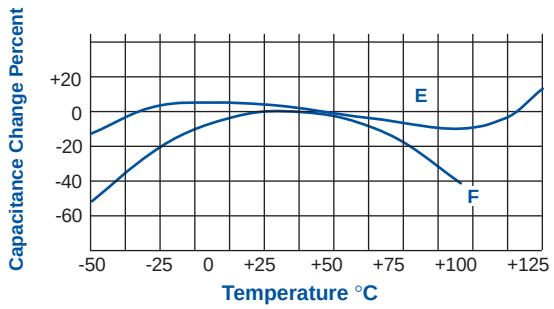
Temperature Coefficient Curves



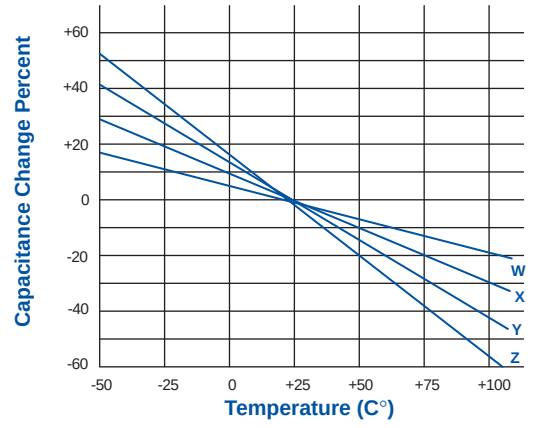
Dielectric Code	TCC
C	NPO 0 ± 30 ppm
L	N080 ± 40 ppm
P	N150 ± 40 ppm
R	N220 ± 50 ppm
Q	P90 ± 20 ppm



Dielectric Code	TCC
S	N330 ± 50 ppm
T	N470 ± 60 ppm
U	N750 ± 100 ppm
V	N1400 ± 250 ppm



Dielectric Code	TCC
B	X7R ±15%
F	Z5U +22%, -56%



Dielectric Code	TCC
W	N2400 ± 400 ppm
X	N3300 ± 600 ppm
Y	N4700 ± 900 ppm
Z	N5600 ± 1,000 ppm

SPECTRUM CONTROL INC.

Single Layer Chip Capacitor Selector Guide

50 Volt

Capacitance (pF)		Case Size						
Value	Code	SP100	SP120	SP150	SP200	SP250	SP300	SP350
0.05	0R05							
0.06	0R06							
0.07	0R07	P, A	P, A	P, A				
0.08	0R08							
0.09	0R09							
0.10	0R1							
0.20	0R2							
0.30	0R3							
0.40	0R4							
0.50	0R5	P, A, B,	P, A, B,	P, A, B,	P, A, B,	P, A, B,		
0.60	0R6	C, D	C, D	C, D	C, D	C, D	P, A, B,	P, A, B,
0.70	0R7						C, D	C, D
0.80	0R8							
0.90	0R9							
1.0	1R0							
1.1	1R1							
1.2	1R2							
1.3	1R3							
1.4	1R4							
1.5	1R5	B, C, D	B, C, D					
1.6	1R6							
1.7	1R7							
1.8	1R8							
1.9	1R9							
2.0	2R0			B, C, D	B, C, D			
2.1	2R1							
2.2	2R2							
2.4	2R4					B, C, D	B, C, D	B, C, D
2.7	2R7							
3.0	3R0							
3.3	3R3							
3.6	3R6							
3.9	3R9							
4.3	4R3	C, D, G,	C, D, G,					
4.7	4R7	J, K, L, M	J, K, L, M					
5.1	5R1							
5.6	5R6							
6.2	6R2							
6.8	6R8							
7.5	7R5							
8.2	8R2							
9.1	9R1							
10	100			C, D, G,	C, D, G,			
11	110			J, K, L, M	J, K, L, M			F, G, J,
12	120							K, L, M
13	130							

Capacitance (pF)		Case Size						
Value	Code	SP100	SP120	SP150	SP200	SP250	SP300	SP350
15	150							
16	160							
18	180	J, K, M	J, K, L, M			C, D, G,	C, D, G,	
20	200					J, K, L, M	J, K, L, M	
22	220							
24	240							
27	270							
30	300							
33	330							
36	360							
39	390							
43	430							G, J, K,
47	470	M						L, M
51	510			J, K, L, M	J, K, L, M			
56	560							
62	620		M					
68	680							
75	750							
82	820							
91	910					J, K, L, M	J, K, L, M	
100	101							
110	111							
120	121			M				
130	131							
150	151				M			
160	161							
180	181							
200	201							J, K, L, M
220	221							
240	241							
270	271					L, M		
300	301						L, M	
330	331							
360	361							
390	391							
430	431							
470	471							
510	511							
560	561							
620	621							L, M
680	681							
750	751							
820	821							
910	911							
1000	102							

Key (Applies to charts on both pages 8 and 9.)

- Hi Q, High Frequency Applications
- High Frequency and Broad Band Applications
- Broad Band Applications

Letters in chart refer to available capacitance tolerance

Dielectric Code as a Function of Temperature Coefficient

Dielectric Code	TCC	Dielectric Code	TCC
C	NPO 0 ± 30 ppm	Q	P90 ± 20 ppm
L	N080 ± 40 ppm	B	±15%
P	N150 ± 40 ppm	F	+ 22% / - 56%
R	N220 ± 50 ppm	W	N2400 ± 400 ppm
S	N330 ± 50 ppm	X	N3300 ± 600 ppm
T	N470 ± 60 ppm	Y	N4700 ± 900 ppm
U	N750 ± 100 ppm	Z	N5600 ± 1,000 ppm
V	N1400 ± 250 ppm		

Capacitance Tolerance

P = ± .01 pF	C = ± .25 pF	G = ± 2%	L = ± 15%
A = ± .05 pF	D = ± .50 pF	J = ± 5%	M = ± 20%
B = ± .10 pF	F = ± 1%	K = ± 10%	Z = + 80 , - 20%

Note: “P” tolerance available for 0.05 pF - 1 pF only.

Tolerance for size SP100 is 5% or greater.

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Single Layer Chip Capacitor Selector Guide

100 Volt

Capacitance (pF)		Case Size								
Value	Code	SP150	SP200	SP250	SP300	SP350	SP500	SP700	SP900	SP910
0.10	0R1									
0.20	0R2									
0.30	0R3									
0.40	0R4									
0.50	0R5	P, A, B,	P, A, B,	P, A, B,	P, A, B,					
0.60	0R6	C, D	C, D	C, D	C, D	P, A, B,				
0.70	0R7					C, D				
0.80	0R8						P, A, B,			
0.90	0R9						C, D			
1.0	1R0									
1.1	1R1									
1.2	1R2									
1.3	1R3									
1.4	1R4									
1.5	1R5									
1.6	1R6									
1.7	1R7									
1.8	1R8									
1.9	1R9									
2.0	2R0	B, C, D	B, C, D							
2.1	2R1									
2.2	2R2									
2.4	2R4			B, C, D	B, C, D					
2.7	2R7					B, C, D	B, C, D			
3.0	3R0									
3.3	3R3							B, C, D		
3.6	3R6									
3.9	3R9									
4.3	4R3									
4.7	4R7								B, C, D	
5.1	5R1									
5.6	5R6									
6.2	6R2									
6.8	6R8									
7.5	7R5									B, C, D
8.2	8R2									
9.1	9R1									
10	100	C, D,	C, D,							
11	110	G, J, K,	G, J, K,							
12	120	L, M	L, M			F, G, J,				
13	130					K, L, M				F, G, J,
15	150									K, L, M
16	160						F, G, J,	F, G, J,		
18	180			C, D,	C, D,		K, L, M	K, L, M		
20	200			G, J, K,	G, J, K,					
22	220			L, M	L, M				F, G, J,	
24	240								K, L, M	
27	270									
30	300									
33	330									

Capacitance (pF)		Case Size								
Value	Code	SP150	SP200	SP250	SP300	SP350	SP500	SP700	SP900	SP910
36	360									
39	390									
43	430					G, J, K,				
47	470	J, K,	J, K,			L, M				
51	510	L, M	L, M							
56	560									
62	620						G, J, K,	G, J, K,		
68	680						L, M	L, M		
75	750									
82	820			J, K,	J, K,					
91	910			L, M	L, M				G, J, K,	
100	101								L, M	
110	111									
120	121		M							
130	131									G, J, K,
150	151									L, M
160	161									
180	181									
200	201					J, K,				
220	221			L, M		L, M				
240	241									
270	271				L, M					
300	301									
330	331						J, K,	J, K,	J, K,	
360	361						L, M	L, M	L, M	
390	391									
430	431									
470	471									
510	511					L, M				
560	561									
620	621									
680	681									
750	751									
820	821									
910	911						L, M			
1000	102									
1100	112							L, M		
1200	122									
1500	152								L, M	
1600	162									
1800	182									
2000	202									J, K,
2200	222									L, M
2400	242									
2700	272									
3000	302									
3300	332									
3600	262									
3900	392									
4300	432									
4700	472									L, M
5000	502									

Ordering Information

SP — **Style**

100 — **Case Size**
See chart above

C — **Dielectric**
See page 8

0R5 — **Capacitance Code**
See selector guide

B — **Capacitance Tolerance**
See chart on page 8

A — **Working Voltage (DC)**
A = 50
B = 100
Higher voltage available upon request

T2 — **End Termination**
T1, T2 and T3 -
(See Terminations on page 4)
S = Single ribbon lead
A = Axial ribbon leads
R = Radial ribbon leads

Notes: The above part number describes a single layer capacitor, .015" ± .005" square, NPO dielectric with a capacitance of .5 pF ± .1 pF, 50 WVDC, and termination T2.

All ribbon leads are pure silver; other metals are available.

Leads are cut to the exact dimensions of the capacitor.

For special requirements, i.e. rectangular parts, consult your Spectrum Control Representative or Spectrum Control Inc.