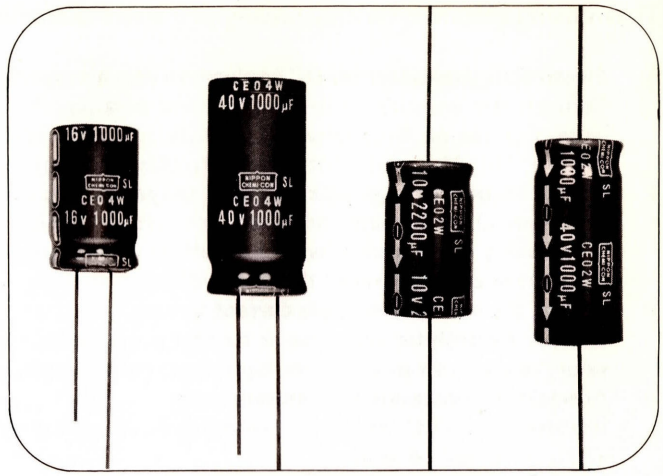
SL Series: General Purpose Plus Special Small Size Miniature Aluminum Electrolytic Capacitors (Single Ended and Axial Lead Types)

Extended temperature range to –40°C and life equal to 1000 hours at 85°C

Miniature aluminum electrolytic capacitors for general purpose are produced in accordance with characteristic W established by JIS C5141. Especially, SL Series items whose voltage rating is less than 100V or 100V maintain high performance and quality. Moreover, their quality has been sharply improved by extending their load life characteristics to 85°C for 1000 hours and by improving their low-temperature characteristics.

SL Series items of 100V or less have the following features:



- Extended temperature range, from –40 to +85°C (JIS, –25° to +70°C).
- Very small leakage current (about one-half of JIS products).
- Small variation and loss of capacity under low temperature.
- Extended high-temperature load characteristics, 85°C for 1000 hours (JIS, 70°C for 500 hours).
- Small tolerance of capacitance, –10 to +50% (C≦4.7μF: –10 to +75%).
- Large permissible ripple current.

□ CHARACTERISTICS

Item	Characteristic	
Voltage Range (V)	100V or less (SL Series)	160 ~ 450
Operating Temperature Range (°C)	–40 ~ +85	–25 ~ +85
Tolerance of Capacitance (%)	Items whose C > 4.7μF –10 ~ +50	–10 to +100 (rated voltage ≦ 350V) –10 to +50 (rated voltage > 350V)
	Items whose C ≦ 4.7μF –10 ~ +75	–10 to +100 (rated voltage ≦ 350V) –10 to +75 (rated voltage > 350V)
Leakage Current (μA)	Less than the greater of 0.03CV and 4, after 5 minutes	0.1CV + 160 (CV ≦ 1000) 0.06CV + 200 (CV > 1000)
	where C = nominal capacitance (μF), V = rated voltage (V)	
Tangent of Loss Angle (tan δ)		

Rated Voltage (V)	6.3	10	16 · 25	35	50 · 63	80 · 100	160 ~ 315	350~
Tan δ	0.24	0.20	0.17	0.12	0.10	0.08	0.2	0.25

For capacitors whose rated voltage is less than 100V or 100V and whose capacitance exceeds 1000μF, the value of tan δ is increased by 0.02 (for every addition of 1000μF

Low-temperature Characteristic

Impedance Ratio

Impedance (Z) Ratio \ Rated Voltage V()	6.3	10	16~100	160~315	350	400~
Z–25°C/Z20°C	4	3	2	12	24	60
Z–40°C/Z20°C	8	6	4	–	–	–

Load Life

The load life characteristic satisfies the conditions listed below after impressing rated voltage for 1000 hours in an atmosphere whose temperature is 85°C and then leaving the capacitor for more than 5 hours at a temperature of 20°C.

Rate of change in capacitance

Voltage Range \ Case Diameter	≦6.3φ	>6.5φ
6.3V	±30%	
10 ~ 25V	±25%	±20%
35 ~ 100V	±20%	±15%

Tan δ ≦ 150% of specified value
Leakage current ≦ specified value

The load life characteristic satisfies the conditions listed below when the capacitors is left for more than 5 hours at 20°C after impressing rated voltage for 1000 hours in an atmosphere whose temperature is 85°C.

Capacitance change ≧ 80% of initial value

Tan δ ≦ 200% of specified value
Leakage current ≦ specified value

Shelf Life

The shelf life characteristic satisfies, the conditions shown below when the capacitor is left for 500 hours an atmosphere whose temperature is 85°C and after leaving it at normal temperature.

Rate of change in capacitance specified value of load life characteristic

Rated of change in capacitance = specified value of load life characteristic
Leakage current ≦ 200% of specified value
Tan δ ≦ 150% of specified value ≦ 200% of specified value

Others	Satisfies characteristic W of JIS C5151.

☐ CASE SIZE OF STANDARD PRODUCTS – FOR NORTH AMERICAN AND EUROPEAN COUNTRIES

D x L (mm)

WV / μF	6.3	10	16	25	35or40	50	63	100	160	200	250	315	350	450
0.47						5x11	5x11	5x11	6.3x11	6.3x11		8x11.5	10x16.5	
1						5x11	5x11	5x11	6.3x11	8x11.5	10x16.5	10x16.5	10x16.5	10x16.5
2.2						5x11	5x11	6.3x11	8x11.5	8x14	10x16.5	10x16.5	10x16.5	13x20.5
3.3						5x11	5x11	8x11.5	10x16.5	10x16.5	10x16.5	10x20.5	10x20.5	13x24.5
4.7					5x11	6.3x11	6.3x11	8x11.5	10x16.5	10x20.5	10x20.5	10x20.5	13x20.5	16x25.5
10			5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x12.5	10x20.5	13x20.5	13x24.5	13x24.5	16x25.5	16x31.5
22		5x11	6.3x11	8x11.5	8x11.5	8x14	10x16.5	10x20.5	13x24.5	16x25.5	16x25.5	16x31.5	16x31.5	
33			6.3x11	8x11.5	8x14	10x16.5	10x16.5	13x20.5	16x25.5	16x25.5	16x31.5	18x35.5	18x35.5	
47		6.3x11	8x11.5	8x14	10x12.5	10x16.5	10x20.5	13x24.5	16x31.5	16x31.5	18x35.5			
100	8x11.5	8x11.5	10x12.5	10x16.5	10x20.5	13x20.5	13x20.5	16x25.5	18x40	18x40				
220	10x12.5	10x16.5	10x20.5	13x20.5	13x24.5	16x25.5	16x25.5	18x35.5						
330	10x16.5	10x20.5	13x20.5	13x24.5	16x25.5	16x31.5	16x31.5							
470	10x20.5	13x20.5	13x20.5	16x25.5	16x25.5	16x35.5	18x35.5							
1000	13x24.5	13x24.5	16x25.5	16x35.5	18x35.5	18x40								
2200	16x25.5	16x31.5	18x35.5	18x40	18x47.5									
3300	16x35.5													

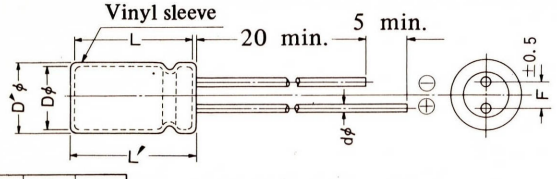
☐ CASE SIZE OF STANDARD PRODUCTS – FOR ASIAN AND JAPANESE CUSTOMERS

D x L (mm)

V / μF	6.3	10	16	25	35	50	63	100	160	250	350	450
0.47						5x11		5x11				
1						5x11		5x11	6.3x11	10x16.5	10x16.5	10x16.5
2.2						5x11	5x11	6.3x11	8x11.5	10x16.5	10x16.5	13x20.5
3.3						5x11	5x11	8x11.5	10x16.5	10x16.5	10x20.5	13x24.5
4.7				5x11	5x11	6.3x11	6.3x11	8x11.5	10x16.5	10x20.5	13x20.5	16x25.5
10			5x11	6.3x11	6.3x11	8x11.5	8x11.5	10x16.5	10x20.5	13x24.5	16x25.5	16x31.5
22		5x11	6.3x11	8x11.5	8x11.5	10x12.5	10x16.5	10x20.5	13x24.5	16x25.5	16x31.5	
33	6.3x11	6.3x11	6.3x11	8x115.	10x12.5	10x16.5	10x16.5	13x20.5	16x25.5	16x31.5	18x35.5	
47	6.3x11	6.3x11	8x11.5	10x12.5	10x12.5	10x16.5	10x20.5	13x24.5	16x31.5	18x35.5		
100	8x11.5	8x11.5	10x12.5	10x16.5	10x20.5	13x20.5	13x24.5	16x25.5	18x40			
220	10x12.5	10x16.5	10x20.5	13x20.5	13x24.5	16x25.5	16x31.5	18x35.5				
330	10x16.5	10x20.5	13x20.5	13x24.5	16x25.5	16x31.5	16x35.5					
470	10x20.5	13x20.5	13x20.5	16x25.5	16x25.5	16x35.5	18x35.5					
1000	13x24.5	13x24.5	16x25.5	16x35.5	18x35.5							
2200	16x25.5	16x31.5	18x35.5									
3300	16x35.5											

☐ DIAGRAM OF DIMENSIONS (VB/SINGLE ENDED)

Unit (mm)



D	F	d
5	2	0.5
6.3	2.5	0.5
8	3.5	0.5
10	5	0.6
13	5	0.6
16	7.5	0.65
18	7.5	0.8

When $D \leqq 8$, $D' \leqq D + 0.5$ and $L' \leqq L + 1$.
When $D > 8$, $D' \leqq D + 1$ and $L' \leqq L + 2$.

Note
Each product whose diameter exceeds 8 mm is equipped sealing rubber with a safety vent, therefore, the case length becomes 1 mm long extra.

Sizes subject to change without notice.

MINIATURE

□ CASE SIZE OF STANDARD PRODUCTS – FOR NORTH AMERICAN AND EUROPEAN COUNTRIES

D x L (mm)

WV / μF	6.3	10	16	25	35or 40	50	63	80	100	160	200	250	315	350	400	450	500
0.47				5x13		5x13	5x13	5x13	5x13	6.3x16		6.3x16		6.3x18	10x20	12.5x20	12.5x20
1				5x13	5x13	5x13	5x13	5x13	5x13	6.3x16		6.3x16		8x18	10 x20	12.5x20	12.5x20
2.2			5x13	5x13	5x13	5x13	5x13	6.3x13	6.3x13	6.3x16		8x18		8x18	10x20	12.5x20	12.5x20
3.3			5x13	5x13	5x13	5x13	5x13	6.3x13	6.3x18	8x18		10x20		10x25	10x30	12.5x25	12.5x25
4.7	5x13		5x13	5x13	5x13	5x13	6.3x13	6.3x16	6.3x18	8x18		10x20		10x25	10x30	12.5x30	16x30
10	5x13	5x13	5x13	5x13	5x13	6.3x16	6.3x18	8x18	8x18	10x20	10x25	10x25	12.5x30	12.5x30	16x30	16x40	16x40
22	5x13	5x13	5x13	6.3x13	6.3x16	8x18	8x18	10x20	10x20	12.5x25	12.5x30	12.5x30	16x30	16x30	16x40	18x40	22x40
33	5x13	5x13	6.3x13	6.3x18	8x16	8x18	10x20	10x25	12.5x25	12.5x30	16x30	16x30	16x40	18x40	18x40	22x40	22x50
47	5x13	5x13	6.3x16	6.3x18	8x18	10x20	10x20	12.5x25	12.5x25	16x30	16x40	18x30	18x40	18x40	22x40	22x50	25.4x50
100	6.3x16	6.3x16	8x16	8x18	10x20	10x25	12.5x25	12.5x30	16x30	18x40	22x40	22x40	22x50	25.4x50	25.4x50		
220	8x18	8x18	10x20	10x25	12.5x25	12.5x30	16x30	16x40	18x40	22x40	22x50						
330	10x20	10x20	10x25	12.5x25	12.5x30	16x30	16x30	18x40	22x40								
470	10x20	10x25	12.5x25	12.5x30	16x30	16x30	16x40	22x40	22x40								
1000	12.5x25	12.5x30	12.5x30	16x30	16x40	22x40	22x40										
2200	16x30	16x30	16x40	18x40	22x40	25.4x50											
3300	16x30	18x40	18x40														
4700	18x40	18x40	22x40														
10000	22x40																

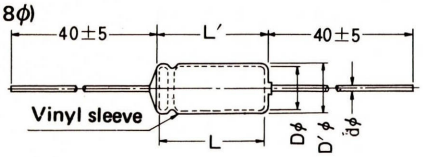
□ CASE SIZE OF STANDARD PRODUCTS – FOR ASIAN AND JAPANESE CUSTOMERS

D x L (mm)

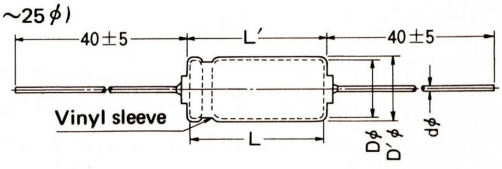
V / μF	6.3	10	16	25	35	50	63	80	100	160	200	250	315	350	400	450	500
0.47				5x12.5		5x12.5	5x12.5	5x12.5	5x12.5	6.3x16		6.3x16		8x20	10x20	12.5x20	12.5x20
1				5x12.5		5x12.5	5x12.5	5x12.5	5x12.5	6.3x16		8x20		8x20	10x20	12.5x20	12.5x20
2.2				5x12.5		5x12.5	5x12.5	6.3x12.5	6.3x12.5	6.3x16		8x20		10x20	10x25	12.5x20	12.5x20
3.3				5x12.5	5x12.5	6.3x12.5	6.3x12.5	6.3x12.5	8x16	8x20		10x20		10x25	10x31.5	12.5x25	12.5x25
4.7				5x12.5	5x12.5	6.3x12.5	6.3x12.5	6.3x16	8x16	8x20		10x20		10x25	10x31.5	12.5x31.5	16x31.5
10		5x12.5	5x12.5	5x12.5	6.3x12.5	6.3x16	8x16	8x20	10x20	10x20	10x25	12.5x25	12.5x31.5	12.5x31.5	16x31.5	16x40	16x40
22		5x12.5	6.3x12.5	6.3x12.5	8x16	8x20	10x20	10x20	10x20	12.5x25	12.5x31.5	16x31.5	16x31.5	16x31.5	16x40	18x40	22.4x40
33		6.3x12.5	6.3x12.5	8x16	8x16	8x20	10x20	10x25	12.5x25	12.5x31.5	16x31.5	16x40	16x40	18x40	18x40	22.4x40	22.4x50
47	6.3x12.5	6.3x12.5	6.3x16	8x16	10x20	10x20	10x20	12.5x25	12.5x25	16x31.5	16x40	18x31.5	18x40	22.4x40	22.4x40	22.4x50	25x50
100	6.3x16	8x16	8x16	10x20	10x20	10x25	12.5x25	12.5x31.5	16x31.5	18x40	22.4x40	22.4x40	25x50	25x50			
220	8x20	10x20	10x20	10x25	12.5x25	12.5x31.5	16x31.5	16x40	18x40	22.4x50	22.4x50						
330	10x20	10x20	10x25	12.5x25	12.5x31.5	16x31.5	16x31.5	18x40	22.4x40								
470	10x20	10x25	12.5x25	12.5x31.5	16x31.5	16x31.5	16x40	22.4x40	22.4x50								
1000	12.5x25	12.5x31.5	16x31.5	16x31.5	16x40	22.4x40	22.4x40										
2200	16x31.5	18x31.5	18x40	22.4x40	22.4x40												
3300	18x40	18x40	22.4x40														
4700	22.4x40	22.4x40	25x40														
10000	25x50																

Unit (mm)

(3.4φ~18φ)



(22φ~25φ)



D	d
3.4~12.5	0.6
16~25	0.8

D'≦D + 1
L'≦L + 2.

Sizes subject to change without notice.

Special Miniature aluminum Electrolytic Capacitors (T/Axial Lead)

CASE SIZE OF STANDARD PRODUCTS

□ **Special Miniature Aluminum Electrolytic Capacitor** D X L(mm)

μF \ V	6.3	10	16	25	40	50	63	80	100
0.47				3.4x11		3.4x11	4.8x11	4.8x11	4.8x11
1				3.4x11	3.4x11	4.8x11	4.8x11	4.8x11	5.7x11
2.2			3.4x11	3.4x11	4.8x11	4.8x11	4.8x11		5.7x11
3.3			3.4x11	4.8x11	4.8x11		5.7x11		
4.7	3.4x11		3.4x11	4.8x11	4.8x11		5.7x11		
10	3.4x11	3.4x11	4.8x11	4.8x11	5.7x11				
22	4.8x11	4.8x11	5.7x11	5.7x11					
33	5.7x11	5.7x11				D'=D+0.2 max.			
47		5.7x11				L'=L+0.5 max.			

Note 1. For the capacitors of case dia. 3.4mm, the load life is 500 hours at 85°C.
Note 2. When placing an order for this type of capacitor, please specify the case size.

SL Series – KA Type

CHARACTERISTICS, STANDARD PRODUCTS AND CASE SIZES

Item	Characteristic
Operating Temperature Range (°C)	–40 to +80
Rated Working Voltage (V)	50
Capacitance Tolerance (%)	±20
Rated Capacitance (μF)	0.1, 0.22 and 0.33
Case Dimensions (Nominal D x L, mm)	VB/Single Ended: 5 x 11 T/Axial Lead: 5 x 13
Tangent of Loss Angle (tan δ)	0.1 maximum
DC Leakage Current (μA)	DC voltage, sufficient to develop the rated voltage across the capacitor, shall be applied in series with a 1000Ω resistor. DC leakage current shall be measured after 30 seconds application of rated voltage, and shall not exceed 1μA.
High Temperature Test	When measured at +85°C, the DC leakage current shall not increase more than 10 times the value specified at +20°C.
Load Life	At the rated DC working, after 1000 hours at +85°C, the capacitor shall meet the following requirements. Capacitance Change: Within ±20% of the initial value. Tangent of Loss Angle: 150% or less of specified value. Leakage Current: Specified value.
Shelf Life	After 500 hours at +85°C, the capacitance shall not change by more than 25%, the tangent of loss angle shall not increase by more than 150% of specified value, and the DC leakage current shall not increase by more than 2 times the value specified at +20°C. No voltage shall be applied during the storage test.
Others	Satisfies characteristic W of JIS C 5141 and our SL series specifications.

DIAGRAM OF DIMENSIONS (VB/SINGLE ENDED)

D x L (mm)

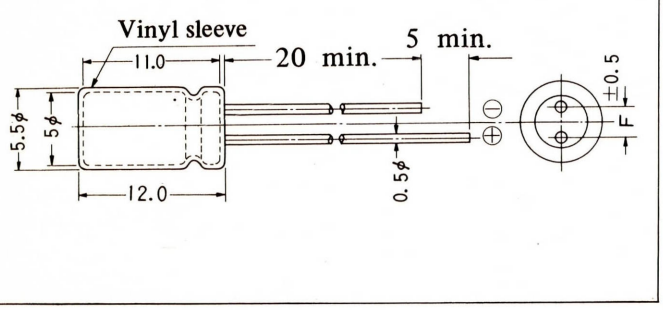
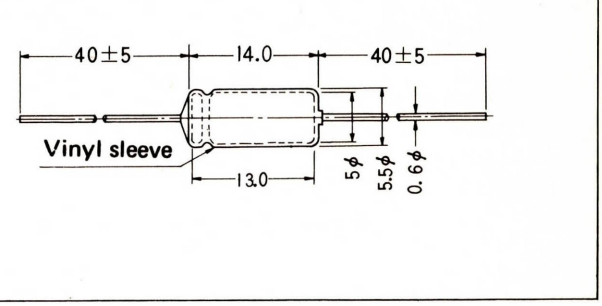


DIAGRAM OF DIMENSIONS (T/AXIAL LEAD)

D x L (mm)



Sizes subject to change without notice.