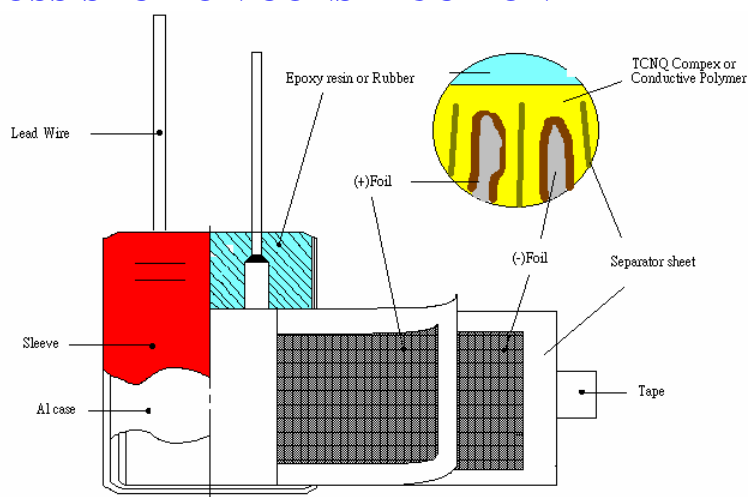


OP CON Solid Aluminum Capacitor

SES & SEL Series

Skywell's OP-CON is aluminum solid electrolytic capacitor that uses organic semiconductors as electrolytes. Organic semiconductor has a high conductivity and high-temperature stability, therefore OP-CON has an excellent performance and high reliability. The constructions of OP-CON are roughly the same as an aluminum electrolytic capacitor.

CROSS-SECTION CONSTRUCTION



-Material Comparison of OP-Con & Conventional Aluminum Capacitors

Type	Aluminum Electrolytic Capacitor	OP-CON
Element Construction	Forming foil, separator, lead wire	Forming foil, separator, lead wire
Dielectric material	AL ₂ O ₃	AL ₂ O ₃
Electrolyte	Electrolytic solution, conductivity, 3mS/cm	Organic semiconductor or Conductivity Polymer
Encapsulation	Rubber	Epoxy resin or Rubber

FEATURES

- Low ESR at high frequency (100KHz ~ 1MHz)
- Excellent of Noise & Ripple removal capability
- Excellent of temperature characteristics (ESR is not dependant on temperature -55°C~+105°C)
- Long-life up to 10000 hours

APPLICATIONS

- Smoothing circuitry of power supply for DC/DC converters
- IC power line noise filter for D/A, A/D converters, TTL & CPUs
- Digital & analog circuitry for audio & video applications
- Replace with large size capacitors on the circuit boards

OP CON Solid Aluminum Capacitor

SES & SEL Series

PART NUMBER SYSTEM

Skywell OP-Con capacitor can be ordered by Skywell part number as follows, such as SEL06T101

SEL	06	T	101	
Type	Voltage	Tolerance	Capacitance	Option
SES=Standard Type	04=4.0v	T=+50-10%	3-digit code	1 or 2 digits
SEL=Low ESR Type	06=6.3v	M=+-20%	(here is 100uF)	P=Polymer
	10=10v	K=+-10%		S=Special size
	16=16v			C=Lead cut
	20=20v			PS=Polymer and Special size
	25=25v			SC=Special size and Lead cut

SES

Standard

- ▶ 105°C, 2000hrs
- ▶ High ripple current
- ▶ Low impedance at high frequency.
- ▶ Suitable for switching power supplies , noise filter

Items	Performance requirements						
Operation temperature range	-55~105°C						
Rated working voltage range	6.3~25V. DC						
Nominal capacitance range	2.2uF~330uF μ F						
Capacitance tolerance	\pm 20%(120Hz/20°C)						
DC leakage current	0.02CV (uA/2min.)						
Dissipation factor (tan δ)	Value in characteristics table						
E.S.R(100~300KHz)	Value in characteristics table						
Temperature characteristics (impedance ratio, 100KHz)	<table border="1"> <tr> <td>-55°C</td> <td>Z/Z20°C</td> <td>1.0 ~ 1.25</td> </tr> <tr> <td>105°C</td> <td>Z/Z20°C</td> <td>0.75 ~ 1.0</td> </tr> </table>	-55°C	Z/Z20°C	1.0 ~ 1.25	105°C	Z/Z20°C	0.75 ~ 1.0
-55°C	Z/Z20°C	1.0 ~ 1.25					
105°C	Z/Z20°C	0.75 ~ 1.0					
High-temperature load (after +105°C, 2000hrs, rated voltage applied, 25V applied +85°C)	<table border="1"> <tr> <td>Δ C/C</td> <td>Within \pm20%</td> </tr> <tr> <td>tan δ</td> <td>1.5 times of initial value</td> </tr> <tr> <td>L/C</td> <td>Less than of initial value</td> </tr> </table>	Δ C/C	Within \pm 20%	tan δ	1.5 times of initial value	L/C	Less than of initial value
Δ C/C	Within \pm 20%						
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L/C	Less than of initial value						
Moisture resistance (after +60°C, 90~95% R.H., 1000hrs, no voltage)	<table border="1"> <tr> <td>Δ C/C</td> <td>Within \pm10%</td> </tr> <tr> <td>tan δ</td> <td>1.5 times of initial value</td> </tr> <tr> <td>L/C</td> <td>Less than of initial value</td> </tr> </table>	Δ C/C	Within \pm 10%	tan δ	1.5 times of initial value	L/C	Less than of initial value
Δ C/C	Within \pm 10%						
tan δ	1.5 times of initial value						
L/C	Less than of initial value						
Reverse voltage guarantee	Less than 10% of the rated voltage						

USA

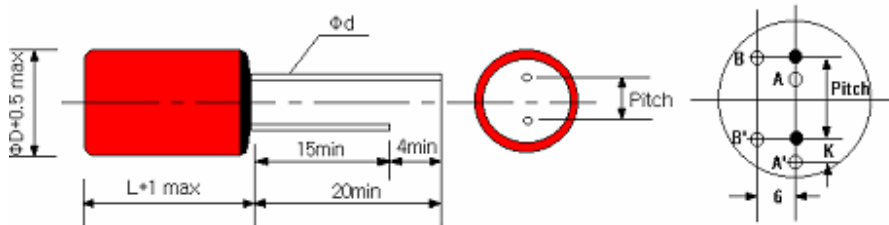
CHINA

TAIWAN

OP CON Solid Aluminum Capacitor

SES & SEL Series

Dimensions & Size Table



(numbers are in mm)

- Dimensions (in mm)

$\Phi D \times L$	5×6.8	6.3×6.8	6.3×9.8	8×10.5	10×10.5
Pitch	2.0±0.5	2.5±0.5	2.5±0.5	3.5±0.5	5.0±0.5
Φd	0.45	0.45	0.5	0.6	0.6
K max	0.5	0.5	0.5	0.8	0.8
G max	0.5	0.5	0.5	0.8	0.8

- Size Table

WV CAP.	6.3V	10V	16V	20V	25V
2.2					5×6.8
3.3					5×6.8
4.7			5×6.8		6.3×6.8
6.8			5×6.8		6.3×6.8
10		5×6.8	6.3×6.8		6.3×6.8
15	5×6.8		6.3×6.8	6.3×6.8	6.3×9.8
22			6.3×6.8	6.3×6.8	8×10.5
33			6.3×6.8	6.3×9.8	8×10.5
47	6.3×6.8	6.3×9.8	6.3×9.8	8×10.5	10×10.5
68		6.3×9.8	8×10.5	8×10.5	
100	6.3×9.8	8×10.5	8×10.5	10×10.5	
150	8×10.5		10×10.5		
220		10×10.5			
330	10×10.5				

USA

CHINA

TAIWAN

- Characteristics Table

W.V.	Cap. (uF)	PART No.	ESR (100~300KHz) (mΩ)(max)	Max. ripple Current (mA rms) (100KHz/ 45°C)	Tan δ	Leakage current(mA)
6.3V	15	SES06M150	120	815	0.05	1.80
	47	SES06M470	60	1430	0.07	5.92
	100	SES06M101	60	2200	0.07	12.60
	150	SES061M51	30	2780	0.07	18.90
	330	SES06M331	25	3500	0.07	41.58
10V	10	SES10M100	150	780	0.05	1.00
	47	SES10M470	60	2020	0.06	9.40
	68	SES10M680	60	2040	0.07	13.60
	100	SES10M101	30	2680	0.07	20.00
	220	SES10M221	27	36370	0.07	44.00
16V	4.7	SES16M4R7	180	720	0.04	1.50
	6.8	SES16M6R8	150	745	0.04	2.18
	10	SES16M100	90	1150	0.04	3.20
	15	SES16M150	90	1230	0.04	4.80
	22	SES16M220	70	1320	0.06	7.04
	33	SES16M330	70	1370	0.06	10.56
	47	SES16M470	60	1830	0.06	15.04
	68	SES16M680	40	2600	0.06	21.80
	100	SES16M101	30	2740	0.08	32.00
	150	SES16M151	28	3260	0.09	48.00
20V	15	SES1150M	90	1200	0.06	6.00
	22	SES20M220	70	1300	0.06	8.80
	33	SES20M330	70	1710	0.06	13.20
	47	SES20M470	40	2450	0.06	18.80
	68	SES20M680	36	2600	0.06	27.20
	100	SES20M101	30	3210	0.06	40.00
25V	2.2	SES20M2R2	200	695	0.03	1.10
	3.3	SES20M3R3	200	700	0.03	1.65
	4.7	SES20M4R7	100	1130	0.03	2.35
	6.8	SES20M6R8	100	1140	0.03	3.40
	10	SES20M100	90	1150	0.03	5.00
	15	SES20M150	70	1650	0.04	7.50
	22	SES20M220	40	2330	0.06	11.00
	33	SES20M330	35	2900	0.06	16.50
	47	SES20M470	35	2980	0.06	23.50

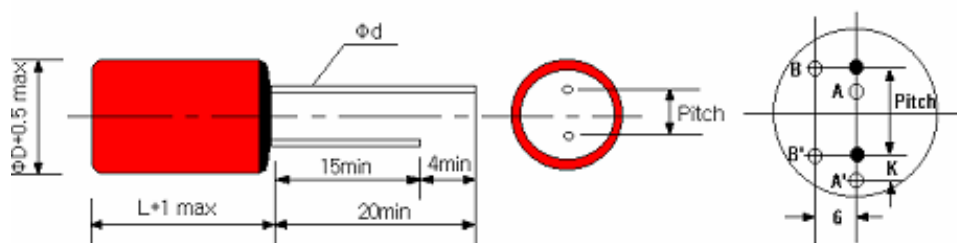
SEL

Large Cap.
Low ESR

- ▶ 105°C, 10000 hours
- ▶ Higher capacitance and lower ESR
- ▶ Suitable for the BACK-UP capacitor and audio equipments

Items	Performance requirement						
Operation Temperature Range	-55~105°C						
Rated Working Voltage Range	2.0V ~25V. DC						
Nominal Capacitance Range	15uF~2200uF μ F						
Capacitance Tolerance	\pm 20%, +50-10% (120Hz/20°C)						
DC Leakage Current	0.1CV (uA/2min.)						
Dissipation Factor (tan δ)	Value in characteristics table						
E.S.R(100~300KHz)	Value in characteristics table						
Temperature Characteristics (impedance ratio, 10KHz)	<table border="1"> <tr> <td>-55°C</td> <td>Z/Z20°C</td> <td>1.0~1.25</td> </tr> <tr> <td>105°C</td> <td>Z/Z20°C</td> <td>0.75~1.0</td> </tr> </table>	-55°C	Z/Z20°C	1.0~1.25	105°C	Z/Z20°C	0.75~1.0
-55°C	Z/Z20°C	1.0~1.25					
105°C	Z/Z20°C	0.75~1.0					
High-Temperature Load (after 105°C, 1000hrs, rated voltage applied, 25V applied 85°C)	<table border="1"> <tr> <td>Δ C/C</td> <td>Within \pm20%</td> </tr> <tr> <td>tan δ</td> <td>1.5 times of initial value</td> </tr> <tr> <td>L/C</td> <td>Less than of initial value</td> </tr> </table>	Δ C/C	Within \pm 20%	tan δ	1.5 times of initial value	L/C	Less than of initial value
Δ C/C	Within \pm 20%						
tan δ	1.5 times of initial value						
L/C	Less than of initial value						
Moisture resistance (after 60°C, 90~95% R.H., 1000hrs, no voltage)	<table border="1"> <tr> <td>Δ C/C</td> <td>Within \pm10%</td> </tr> <tr> <td>tan δ</td> <td>1.5 times of initial value</td> </tr> <tr> <td>L/C</td> <td>Less than of initial value</td> </tr> </table>	Δ C/C	Within \pm 10%	tan δ	1.5 times of initial value	L/C	Less than of initial value
Δ C/C	Within \pm 10%						
tan δ	1.5 times of initial value						
L/C	Less than of initial value						
Reverse voltage guarantee	Less than 10% of the rated voltage						

DIMENSIONS & SIZE TABLE



(numbers are in mm)

USA

CHINA

TAIWAN

- Dimensions (in mm)

$\Phi D \times L$	6.3x6.8	6.3x9.8	8x10.5	8x11.5	10x10.5	10x12.5
Pitch	2.5±0.5	2.5±0.5	3.5±0.5	3.5±0.5	5.0±0.5	5.0±0.5
Φd	0.45	0.5	0.6	0.6	0.6	0.6
K max	0.5	0.5	0.8	0.8	0.8	0.8
G max	0.5	0.5	0.8	0.8	0.8	0.8

- Size Table ($\Phi D \times L$)

WV CAP.	2.5V	4V	6.3V	10V	16V	20V	25V
33						6.3x6.8	8x10.5
47					6.3x6.8		
56							10x10.5
68						6.3x9.8	
82				6.3x6.8			
100					6.3x9.8		
120			6.3x6.8			8x10.5	
150		6.3x6.8		6.3x9.8			
180			6.3x9.8		8x10.5	10x10.5	
270		6.3x9.8		8x10.5	10x10.5		
330					10x12.5 10x10.5		
390			8x10.5				
470			10x10.5	10x10.5			
510		8x10.5					
560		8x10.5					
680			10x10.5				
820	8x11.5	10x10.5	10x12.5 10x10.5				
1200		10x12.5 10x10.5					
1500	10x12.5						

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- Characteristics Table

W.V.	Cap. (uF)	Part No.	ESR (100~300Khz) (mΩ)(max)	Max. ripple Current (mA) (100Khz/ 45°C)	Tan δ	Leakage Current (mA)
2.5V	820	SEL2R5M821	7	5600	0.07	512.5
	1500	SEL2R5M152	12	5440	0.08	750
4.0V	150	SEL04M151	35	1930	0.07	60.0
	270	SEL04M271	20	3160	0.08	108.0
	510	SEL04T511	14	4010	0.08	202.0
	560	SEL04M561	14	4080	0.08	224.0
	820	SEL04M821	12	5040	0.08	328.0
	1200	SEL04M122	12	5440	0.08	960.0
	1200	SEL04M122S	12	5440	0.08	960.0
6.3V	120	SEL06M121	35	1930	0.07	575.6
	180	SEL06M181	29	2990	0.07	113.4
	390	SEL06M391	16	3810	0.08	245.7
	680	SEL06M681	13	4840	0.08	428.4
	820	SEL06M821	12	5440	0.08	774.90
	820	SEL06M821S	12	5440	0.08	774.90
10V	82	SEL10M820	40	1850	0.07	82.0
	150	SEL10M151	30	2990	0.07	150.0
	270	SEL10M271	16	3600	0.08	270.0
	470	SEL10M471	15	4510	0.08	470.0
16V	47	SEL16M470	45	1710	0.07	75.20
	100	SEL16M101	25	2820	0.08	160.0
	180	SEL16M181	20	3410	0.08	288.0
	270	SEL16M271	18	4400	0.08	432.0
	330	SEL16M331	16	4720	0.08	528.0
	330	SEL16M331S	16	4720	0.08	528.0
20V	330	SEL16M331P	7	6100(105°C)	0.12	1056.0
	33	SEL20M330	45	1710	0.07	66.0
	68	SEL20M680	30	2580	0.08	136.0
	120	SEL20M121	24	3110	0.08	240.0
25V	180	SEL20M181	20	4280	0.08	360.0
	33	SEL25M330	30	2780	0.08	82.5
	56	SEL25M560	25	3260	0.08	140.0

Remark: SEL04M122S, SEL06M821S and SEL16M331S are special size of 10x10.5 (ΦD×L).

CHARACTERISTICS NOTES:

1. Ripple Current

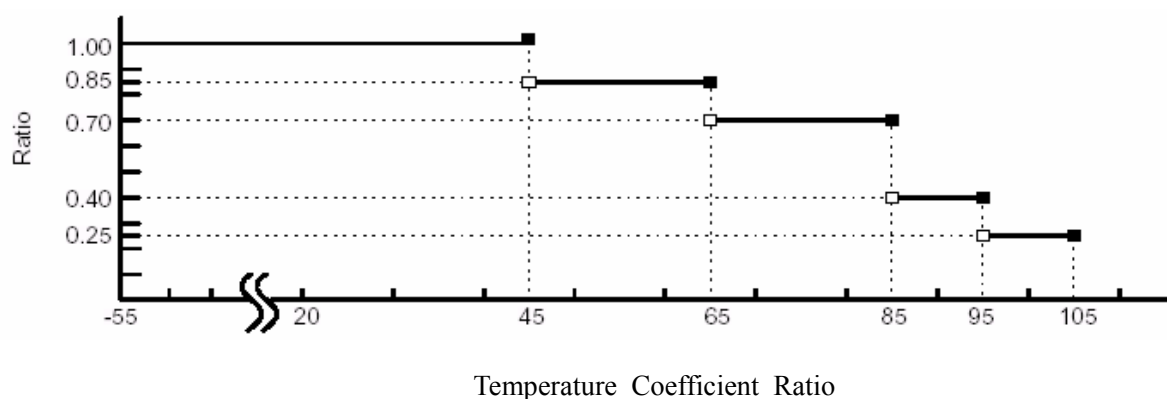
For maximum allowable ripple current (45°C 100KHz), See characteristics table c.f. maximum allowable ripple current at ambient temperature.

$$I_x \text{ mA rms (+65°C)} = 0.85 \times I_o \text{ mA rms (+45°C)}$$

$$I_x \text{ mA rms (+85°C)} = 0.7 \times I_o \text{ mA rms (+45°C)}$$

$$I_x \text{ mA rms (+95°C)} = 0.4 \times I_o \text{ mA rms (+45°C)}$$

$$I_x \text{ mA rms (+105°C)} = 0.25 \times I_o \text{ mA rms (+45°C)}$$



2. Equivalent Series Resistance (ESR)

At the frequency from 100KHz to 300KHz, the ESR should stay the same, for detail ESR specification, please refer to Characteristics Table.

OPERATION PRECAUTIONS

1. Polarity

Confirm the polarity, do not reverse the polarity when using.

2. Prohibits Circuits

- 1) High impedance voltage retention circuits
- 2) Coupling circuits
- 3) Time constant circuits
- 4) Circuits greatly affected by leakage current

3. Over Voltage Prohibited During Design

4. Sudden Charge & Discharge Restricted (for maintenance of high proof reliability)

5. Considerations When Soldering

- 1) Do not solder the **OP-CON** by submerging it in melted solder.
- 2) Soldering condition: less than 10 seconds at 260°C
- 3) The leakage current value after soldering may increase a little depending on the soldering conditions. But the leakage current can be reduced through self-repaired by applying voltage.

APPLICATION NOTES

1. Operating Temperature

Use the **OP-CON** according to the specified operating temperature range.

2. Ripple Current

Never make current larger than the permissible ripple current.

3. Leakage Current

Leakage current increases slightly during high temperature no-load, damp heat load and rapid change of temperature with no voltage applied. However, leakage current will decrease by applying voltage at the maximum operating temperature in case it happened.

4. Applied Voltage

For 2.5 to 20WV products and 30WV products, 100% of the rated voltage can be applied without causing any problem. Use less than 80% of the following temperature reduction voltage for 25WV products. The reliability of OP-CON, it is recommended that voltage applied to them should be less than 80% of the rated voltage. If the 25V rating are used at the temperature higher than 85, apply the temperature reducing voltage described as: 85°C→25V, 95°C→22.5V 105°C→20V for the 2.5V to 20V rating, the reverse voltage should be less than 20% of the rating voltage for an extremely short period less than 10% for a certain continuous period.

5. Failure Mode

OP-CON may end worn-out in association with temperature. They may be defected accidentally by over-voltage or over-current mainly causing short circuit. The failure rate is dependent on the applied voltage and the ambient temperature.

SES and SEL series products are conformed to RoHS.

Contact Skywell's branch office nearest you or email to sales@skywellnet.com if you have any question.