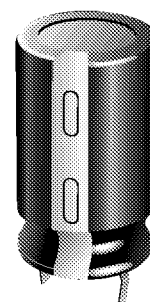


Aluminum Electrolytic Capacitors (Large Can Type)

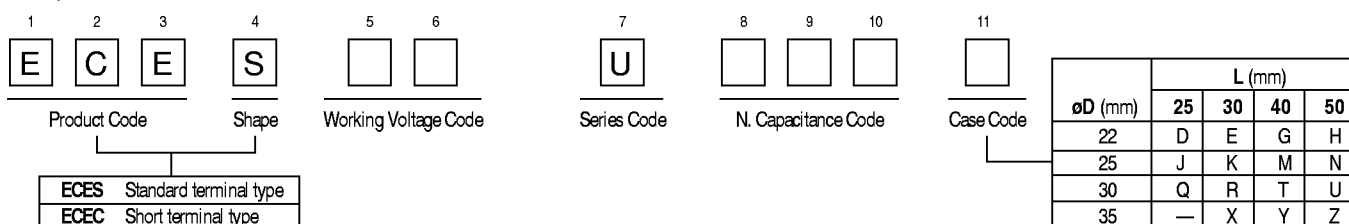
Series: TS-U



■ Features

- General purpose
- Wide CV value range (33 ~ 47,000 μF /16~450V)
- Various case sizes
- Top vent construction

■ Explanation of Part Numbers



■ Specifications

Operating temperature range	-40 to +85°C	-25 to +85°C																				
Rated working voltage	16 to 250 V DC	385 to 450 V DC																				
Nominal capacitance range	120 to 47,000 μF	33 to 390 μF																				
Capacitance tolerance	±20% (120 Hz/+20°C)																					
DC leakage current	$I = 0.01 CV [\mu\text{A}]$ $CV \leq 1,000,000$ for 16 ~ 100V $I = 3 \sqrt{CV} [\mu\text{A}]$ $CV > 1,000,000$ for 16 ~ 100 V and all items of 160 ~ 450V Leakage current shall be measured after 5 minutes application of rated working voltage at +20°C. (C = nominal capacitance in μF , V = rated working voltage in V)																					
tan δ	(120 Hz/+20°C)																					
	W.V. (V)	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>16</td> <td>25</td> <td>35</td> <td>50</td> <td>63</td> <td>80-400</td> <td>450</td> </tr> <tr> <td>tan δ</td> <td>0.35</td> <td>0.30</td> <td>0.25</td> <td>0.20</td> <td>0.20</td> <td>0.15</td> <td>0.20</td> </tr> </table>	16	25	35	50	63	80-400	450	tan δ	0.35	0.30	0.25	0.20	0.20	0.15	0.20					
16	25	35	50	63	80-400	450																
tan δ	0.35	0.30	0.25	0.20	0.20	0.15	0.20															
Ripple current	Refer to standard products table (120 Hz, +105°C) Correction factor for frequency																					
	Frequency [Hz]	<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td>50</td> <td>60</td> <td>120</td> <td>500</td> <td>1k</td> <td>10k-50k</td> </tr> <tr> <td>16 ~ 100V</td> <td>0.93</td> <td>0.95</td> <td>1.00</td> <td>1.05</td> <td>1.08</td> <td>1.15</td> </tr> <tr> <td>160 ~ 450V</td> <td>0.75</td> <td>0.80</td> <td>1.00</td> <td>1.20</td> <td>1.25</td> <td>1.40</td> </tr> </table>	50	60	120	500	1k	10k-50k	16 ~ 100V	0.93	0.95	1.00	1.05	1.08	1.15	160 ~ 450V	0.75	0.80	1.00	1.20	1.25	1.40
	50	60	120	500	1k	10k-50k																
16 ~ 100V	0.93	0.95	1.00	1.05	1.08	1.15																
160 ~ 450V	0.75	0.80	1.00	1.20	1.25	1.40																
Endurance	Test conditions																					
	Duration	2,000 hours																				
	Ambient temperature	+85°C																				
	Applied voltage	DC voltage with maximum permissible ripple current specified at +85°C (\leq rated working voltage)																				
	Post-test requirements at +20°C																					
	Leakage current	\leq initial specified value																				
	Capacitance change	$\pm 20\%$ of initial measured value																				
tan δ	$\leq 150\%$ of initial specified value																					
Shelf life	Test conditions (Post-test requirements at +20°C. Same limits as "Endurance".)																					
	Duration	1,000 hours																				
	Ambient temperature	+85°C																				
	Applied voltage	(none)																				
	Pre-treatment for measurements: Measurements shall be conducted after application of DC working voltage for 30 minutes																					

Expected Life for Ripple Current and Ambient Stress

■ Calculation Formula

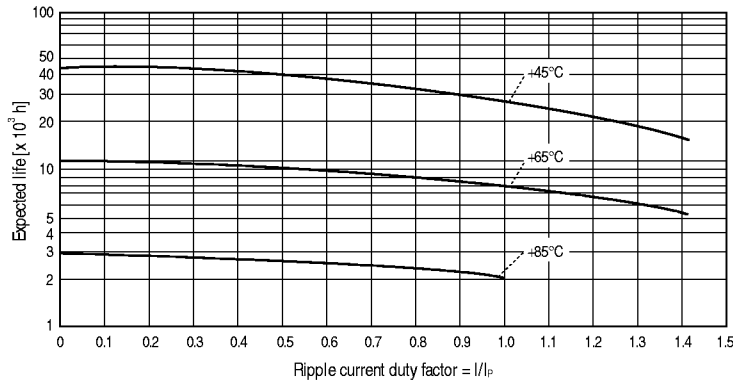
The life of aluminum electrolytic capacitors is highly affected by applied ripple current and ambient temperature. In general, the relation between life time, ripple current, and ambient temperature is known as:

Where:

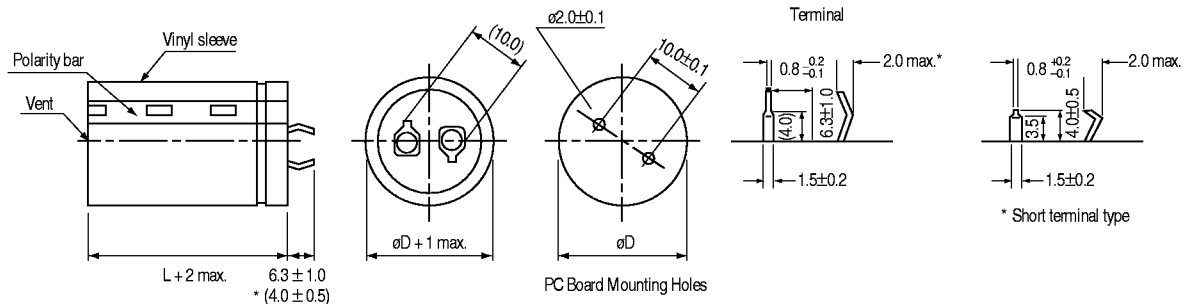
- I: Ripple current to be applied to the capacitor T°C (120 Hz... [A rms]
- I_p: Specified maximum permissible ripple current at 120 Hz, +85°C... [A rms]
- L: Expected life at T°C... [h]
- L₀: Specified life (series TS-U: 2,000 hours)... [h]
- T: Ambient temperature [°C]
- T₀: Hot spot temperature in the capacitor element = [maximum operating temperature] + [Δt at maximum ambient temperature] = [maximum temperature (series TS-U: +90°C)]... [°C]
- Δt: Temperature rise at constant current flow of maximum permissible ripple current value specified at +85°C (see graph1 Δt vs T)... [°C]

Conditions: (I/I_p)² ≤ 2 times

■ Expected Life (calculated on the basis of specified life under high temperature loading)



■ Dimensions in mm (not to scale)



■ Case Size

Cap. (μF) (code)	Ripple Current*	Case size øD x L (mm)			
16V					
4,700	1.60	22x25			
6,800	1.80	22x30	25x25		
10,000	2.40	22x40	25x30	30x25	
15,000	3.20	22x50	25x40	30x30	
22,000	3.60		25x50	30x40	35x30
33,000	4.40			30x50	35x40
47,000	4.70				35x50

35V					
2,200	1.40	22x25			
3,300	1.70	22x30	25x25		
4,700	2.00	22x40	25x30	30x25	
6,800	2.40	22x50	25x40	30x30	
10,000	3.00		25x50	30x40	35x30
15,000	3.70			30x50	35x40
22,000	4.00				35x50

63V					
1,000	1.20	22x25			
1,500	1.30	22x30	25x25		
2,200	1.50	22x40	25x30	30x25	
3,300	1.90	22x50	25x40	30x30	
4,700	2.30		25x50	30x40	35x30
6,800	3.00			30x50	35x40
10,000	3.30				35x50

100V					
470	1.00	22x25			
680	1.10	22x30	25x25		
1,000	1.20	22x40	25x30	30x25	
1,500	1.50	22x50	22x40	30x30	
2,200	1.80		22x50	30x40	35x30
3,300	2.40			30x50	35x40
4,700	2.70				35x50

200V					
150	0.65	22x25			
220	0.87	22x30	35x25		
330	1.10	22x40	25x30	30x25	
470	1.30	22x50	25x40	30x30	
680	1.50		25x50	30x40	35x30
1,000	1.80			30x50	35x40
1,200	2.00				35x50

385/400V					
47	0.25	22x25			
68	0.35	22x30	25x25		
100	0.47	22x40	25x30	30x25	
150	0.60	22x50	25x40	30x30	
220	0.75		25x50	30x40	35x30
270	0.90			30x50	35x40
390	1.10				35x50

Cap. (μF) (code)	Ripple Current*	Case size øD x L (mm)			
25V					
3,300	1.60	22x25			
4,700	1.80	22x30	25x25		
6,800	2.30	22x40	25x30	30x25	
10,000	2.70	22x50	25x40	30x30	
15,000	3.40		25x50	30x40	35x30
22,000	4.20			30x50	35x40
33,000	4.60				35x50

50V					
1,500	1.20	22x25			
2,200	1.40	22x30	25x25		
3,300	1.70	22x40	25x30	30x25	
4,700	2.10	22x50	25x40	30x30	
6,800	2.60		25x50	30x40	35x30
10,000	3.40			30x50	35x40
15,000	3.70				35x50

80V					
680	1.00	22x25			
1,000	1.20	22x30	25x25		
1,500	1.40	22x40	25x30	30x25	
2,200	1.70	22x50	25x40	30x30	
3,300	2.10		25x50	30x40	35x30
4,700	2.60			30x50	35x40
6,800	3.10				35x50

160V					
180	0.65	22x25			
270	0.87	22x30	25x25		
390	1.10	22x40	25x30	30x25	
560	1.30	22x50	25x40	30x30	
820	1.50		25x50	30x40	35x30
1,200	1.80			30x50	35x40
1,500	2.00				35x50

250V					
120	0.45	22x25			
150	0.65	22x30	25x325		
220	0.87	22x40	25x30	30x25	
330	1.10	22x50	25x40	3x30	
470	1.30		25x30	30x40	35x30
680	1.50			30x50	35x40
1,000	1.90				35x50

450V					
33	0.20	22x25			
47	0.29	22x30	25x25		
68	0.38	22x40	25x30	30x25	
100	0.52	22x50	25x40	30x30	
150	0.70		25x50	30x40	35x30
220	0.92			30x50	35x40
330	1.10				35x50

* Ripple current: [A] rms at 120 Hz +85°C

Note: When capacitors of ø35 x 50 are mounted to P.C.B., reinforce them with supplementary support or adhesives. (Avoid using adhesives including halogenated composition.)

■ Standard Products

W.V. (V DC)	Cap. (μ F)	Part No.	Case Size ϕ D x L (mm)	Leakage Current (+20°C/5 min) [mA] max.	$\tan \delta$ (120 Hz/+20°C) max.	Ripple Current [A] rms max. (120 Hz/+85°C, 2000h)
16	4,700	ECES1CU472D	22 x 25	0.75	0.35	0.160
	6,800	ECES1CU682E	22 x 30	0.98	0.35	1.80
		ECES1CU682J	25 x 25			
	10,000	ECES1CU103G	22 x 40	1.20	0.35	2.40
		ECES1CU103K	25 x 30			
		ECES1CU103Q	30 x 25			
	15,000	ECES1CU153H	22 x 50	1.46	0.35	3.20
		ECES1CU153M	25 x 40			
ECES1CU153R		30 x 30				
22,000	ECES1CU223N	25 x 50	1.77	0.35	3.60	
	ECES1CU223T	30 x 40				
	ECES1CU223X	35 x 30				
33,000	ECES1CU333U	30 x 50	2.17	0.35	4.40	
	ECES1CU333Y	35 x 40				
47,000	ECES1CU473Z	35 x 50	2.60	0.35	4.70	
25	3,300	ECES1EU332D	22 x 25	0.82	0.30	1.60
	4,700	ECES1EU472E	22 x 30	1.02	0.30	1.80
		ECES1EU472J	25 x 25			
	6,800	ECES1EU682G	22 x 40	1.23	0.30	2.30
		ECES1EU682K	25 x 30			
		ECES1EU682Q	30 x 25			
	10,000	ECES1EU103H	22 x 50	1.50	0.30	2.70
		ECES1EU103M	25 x 40			
ECES1EU103R		30 x 30				
15,000	ECES1EU153N	25 x 50	1.83	0.30	3.40	
	ECES1EU153T	30 x 40				
	ECES1EU153X	35 x 30				
22,000	ECES1EU223U	30 x 50	2.22	0.30	4.20	
	ECES1EU223Y	35 x 40				
33,000	ECES1EU333Z	35 x 50	2.72	0.30	4.60	
35	2,200	ECES1VU222D	22 x 25	0.77	0.25	1.40
	3,300	ECES1VU332E	22 x 30	1.01	0.25	1.70
		ECES1VU332J	25 x 25			
	4,700	ECES1VU472G	22 x 40	1.21	0.25	2.00
		ECES1VU472K	25 x 30			
		ECES1VU472Q	30 x 25			
	6,800	ECES1VU682H	22 x 50	1.46	0.25	2.40
		ECES1VU682M	25 x 40			
ECES1VU682R		30 x 30				
10,000	ECES1VU103N	25 x 50	1.77	0.25	3.00	
	ECES1VU103T	30 x 40				
	ECES1VU103X	35 x 30				
15,000	ECES1VU153U	30 x 50	2.17	0.25	3.70	
	ECES1VU153Y	35 x 40				
22,000	ECES1VU223Z	35 x 50	2.63	0.25	4.00	
50	6,800	ECES1HU152D	22 x 25	1.74	0.20	2.60
	2,000	ECES1HU222E	22 x 30	0.99	0.20	1.40
		ECES1HU222J	25 x 25			
	3,300	ECES1HU332G	22 x 30	1.21	0.20	1.70
		ECES1HU332K	25 x 30			
		ECES1HU332Q	30 x 25			
4,700	ECES1HU472H	22 x 50	1.45	0.20	2.10	
	ECES1HU472M	25 x 40				
	ECES1HU472R	30 x 30				

■ Standard Products (cont'd)

W.V. (V DC)	Cap. (μ F)	Part No.	Case Size ϕ D x L (mm)	Leakage Current (+20°C/5 min) [mA] max.	$\tan \delta$ (120 Hz/+20°C) max.	Ripple Current [A] rms max. (120 Hz/+85°C, 2000h)
50	6,800	ECES1HU682N	25 x 50	1.74	0.20	2.60
		ECES1HU682T	30 x 40			
		ECES1HU682X	35 x 30			
	10,000	ECES1HU103U	30 x 50	2.12	0.20	3.40
		ECES1HU103Y	35 x 40			
		ECES1HU153Z	35 x 50			
63	1,000	ECES1JU102D	22 x 25	0.63	0.20	1.20
	1,500	ECES1JU152E	22 x 30	0.94	0.20	1.30
		ECES1JU152J	25 x 25			
	2,200	ECES1JU222G	22 x 40	1.11	0.20	1.50
		ECES1JU222K	25 x 30			
		ECES1JU222Q	30 x 25			
	3,300	ECES1JU332H	22 x 50	1.36	0.20	1.90
		ECES1JU332M	25 x 40			
		ECES1JU332R	30 x 30			
	4,700	ECES1JU472N	25 x 50	1.63	0.20	2.30
		ECES1JU472T	30 x 40			
		ECES1JU472X	35 x 30			
6,800	ECES1JU682U	30 x 50	1.96	0.20	3.00	
	ECES1JU682Y	35 x 40				
	ECES1JU103Z	35 x 50				
80	680	ECES1KU681D	22 x 25	0.54	0.15	1.00
	1,000	ECES1KU102E	22 x 30	0.80	0.15	1.20
		ECES1KU102J	25 x 25			
	1,500	ECES1KU152G	22 x 40	1.03	0.15	1.40
		ECES1KU152K	25 x 30			
		ECES1KU152Q	30 x 25			
	2,200	ECES1KU222H	22 x 50	1.25	0.15	1.70
		ECES1KU222M	25 x 40			
		ECES1KU222R	30 x 30			
	3,300	ECES1KU332N	25 x 50	1.54	0.15	2.10
ECES1KU332T		30 x 40				
ECES1KU332X		35 x 30				
4,700	ECES1KU472U	30 x 50	1.83	0.15	2.60	
	ECES1KU472Y	35 x 40				
	ECES1KU682Z	35 x 50				
100	470	ECES2AU471D	22 x 25	0.47	0.15	1.00
	680	ECES2AU681E	22 x 30	0.68	0.15	1.10
		ECES2AU681J	25 x 25			
	1,000	ECES2AU102G	22 x 40	1.00	0.15	1.20
		ECES2AU102K	25 x 30			
		ECES2AU102Q	30 x 25			
	1,500	ECES2AU152H	22 x 50	1.16	0.15	1.50
		ECES2AU152M	25 x 40			
		ECES2AU152R	30 x 30			
	2,200	ECES2AU222N	25 x 50	1.40	0.15	1.80
ECES2AU222T		30 x 40				
ECES2AU222X		35 x 30				
3,300	ECES2AU332U	30 x 50	1.72	0.15	2.40	
	ECES2AU332Y	35 x 40				
4,700	ECES2AU472Z	35 x 50	2.05	0.15	2.70	

■ Standard Products (cont'd)

W.V. (V DC)	Cap. (μ F)	Part No.	Case Size ϕ D x L (mm)	Leakage Current (+20°C/5 min) [mA] max.	$\tan \delta$ (120 Hz/+20°C) max.	Ripple Current [A] rms max. (120 Hz/+85°C, 2000h)
160	180	ECES2CU181D	22 x 25	0.50	0.15	0.65
	270	ECES2CU271E	22 x 30	0.62	0.15	0.87
		ECES2CU271J	25 x 25			
	390	ECES2CU391G	22 x 40	0.74	0.15	1.10
		ECES2CU391K	25 x 30			
		ECES2CU391Q	30 x 25			
	560	ECES2CU561H	22 x 50	0.89	0.15	1.30
		ECES2CU561M	25 x 40			
ECES2CU561R		30 x 30				
820	ECES2CU821N	25 x 50	1.08	0.15	1.50	
	ECES2CU821T	30 x 40				
	ECES2CU821X	35 x 30				
1,200	ECES2CU122U	30 x 50	1.31	0.15	1.80	
	ECES2CU122Y	35 x 40				
1,500	ECES2CU152Z	35 x 50	1.46	0.15	2.00	
200	150	ECES2DU151D	22 x 25	0.51	0.15	0.65
	220	ECES2DU221E	22 x 30	0.62	0.15	1.10
		ECES2DU221J	25 x 25			
	330	ECES2DU331G	22 x 40	0.77	0.15	1.10
		ECES2DU331K	25 x 30			
		ECES2DU331Q	30 x 25			
	470	ECES2DU471H	22 x 50	0.91	0.15	1.30
		ECES2DU471M	25 x 40			
ECES2DU471R		30 x 30				
680	ECES2DU681N	25 x 50	1.10	0.15	1.50	
	ECES2DU681T	30 x 40				
	ECES2DU681X	35 x 30				
1,000	ECES2DU102U	30 x 50	1.34	0.15	1.80	
	ECES2DU102Y	35 x 40				
1,200	ECES2DU122Z	35 x 50	1.46	0.15	2.00	
250	120	ECES2EU121D	22 x 25	0.51	0.15	0.45
	150	ECES2EU151E	22 x 30	0.58	0.15	0.65
		ECES2EU151J	25 x 25			
	220	ECES2EU221G	22 x 40	0.70	0.15	0.87
		ECES2EU221K	25 x 30			
		ECES2EU221Q	30 x 25			
	330	ECES2EU331H	22 x 50	0.86	0.15	1.10
		ECES2EU331M	25 x 40			
		ECES2EU331R	30 x 30			
470	ECES2EU471N	25 x 50	1.02	0.15	1.30	
	ECES2EU471T	30 x 40				
	ECES2EU471X	35 x 30				
680	ECES2EU681U	30 x 50	1.50	0.15	1.80	
	ECES2EU681Y	35 x 40				
1,000	ECES2EU102Z	35 x 50	0.41	0.15	0.25	

■ Standard Products (cont'd)

W.V. (V DC)	Cap. (μ F)	Part No.	Case Size ϕ D x L (mm)	Leakage Current (+20°C/5 min) [mA] max.	tan δ (120 Hz/+20°C) max.	Ripple Current [A] rms max. (120 Hz/+85°C, 2000h)
*400	47	ECES2GU470D	22 x 25	0.41	0.15	0.25
	68	ECES2GU680E	22 x 30	0.49	0.15	0.35
		ECES2GU680J	25 x 25			
	100	ECES2GU101G	22 x 40	0.60	0.15	0.47
		ECES2GU101K	25 x 30			
		ECES2GU101Q	30 x 25			
	150	ECES2GU151H	22 x 50	0.73	0.15	0.60
		ECES2GU151M	25 x 40			
ECES2GU151R		30 x 30				
220	ECES2GU221N	25 x 50	0.88	0.15	0.75	
	ECES2GU221T	30 x 40				
	ECES2GU221X	35 x 30				
270	ECES2GU271U	30 x 50	0.98	0.15	0.90	
	ECES2GU271Y	35 x 40				
390	ECES2GU391Z	35 x 50	1.18	0.15	1.10	
450	33	ECES2WU330D	22 x 25	0.37	0.20	0.20
	47	ECES2WU470E	22 x 50	0.43	0.20	0.29
		ECES2WU470J	25 x 25			
	68	ECES2WU680G	22 x 40	0.52	0.20	0.38
		ECES2WU680K	25 x 50			
		ECES2WU680Q	30 x 25			
	100	ECES2WU101H	22 x 50	0.63	0.20	0.52
		ECES2WU101M	25 x 40			
ECES2WU101R		30 x 50				
150	ECES2WU151N	25 x 50	0.77	0.20	0.70	
	ECES2WU151T	30 x 40				
	ECES2WU151X	35 x 50				
220	ECES2WU221U	30 x 50	0.94	0.20	0.92	
	ECES2WU221Y	35 x 40				
330	ECES2WU331Z	35 x 50	1.15	0.20	1.10	

* 385 W.V. is available on request with same specifications (Part No. ECES2TU□□□□).