

## TS-HA Series 105°C, 3000 hours\*

- High ripple current capability
- 20mm lengths for low profile applications
- 2 and 3 pin versions available



Rated Working Voltage:	10 ~ 250 VDC	385 ~ 450 VDC
Operating Temperature:	-40 ~ +105°C	-25 ~ +105°C
Nominal Capacitance:	68 ~ 82000µF (±20% tolerance)	33 ~ 470µF (±20% tolerance)
Dissipation Factor: (120 Hz, +20°C)	Working Voltage [V]:	10 16 25 35 50 63 80 100 - 450
	Max. D.F. (%):	55 45 35 30 25 20 17 15
For capacitance values > 33000µF, add the value of: $\frac{\text{rated cap. } [\mu\text{F}] - 33000}{1000}$		
Leakage Current:	3√CV (µA) max. after 5 minutes; C = Capacitance in µF, V = WV	
Ripple Current Multipliers:	Frequency(Hz):	50 60 100-120 500 1k 10k- 10-100WV: 0.93 0.95 1.0 1.05 1.08 1.15 160-450WV: 0.75 0.8 1.0 1.2 1.25 1.4
	Ripple Current Ambient Temperature Factors** Ambient Temperature: 105°C 85°C 70°C 60°C ≤45°C Multiplier: 1.0 1.7 2.0 2.2 2.35	
Endurance:	3000 hours at +105°C with maximum specified ripple current (see page 6) *2000 hours for 20mm length sizes	

\*\*Use of temperature ripple current multipliers may limit life to the hours specified for the maximum operating temperature.

### Part Number System



### TS-HA Standard Ratings (part numbers shown with 2 pins, 6.3mm length terminal, and top vinyl plate)

Cap. (µF)	Size (mm) D x L	Max 105°C R.C. (A <sub>rms</sub> )		20°C ESR (Ω, max.)		Panasonic Part Number	Cap. (µF)	Size (mm) D x L	Max 105°C R.C. (A <sub>rms</sub> )		20°C ESR (Ω, max.)		Panasonic Part Number	
		120Hz	10kHz~	120Hz	20kHz				120Hz	10kHz~	120Hz	20kHz		
<b>10 VDC Working, 13 VDC Surge</b>							<b>16 VDC Working, 20 VDC Surge (continued)</b>							
4700	22 x 25	0.85	0.98	0.159	0.135	ECOS1AA472BA	10000	35 x 20	2.40	2.76	0.071	0.057	ECOS1CA103EL	
6800	22 x 25	1.30	1.50	0.110	0.093	ECOS1AA682BA	12000	22 x 35	2.90	3.34	0.055	0.044	ECOS1CA123BA	
10000	22 x 25	1.80	2.07	0.075	0.063	ECOS1AA103BA		25 x 30	2.90	3.34	0.055	0.044	ECOS1CA123CA	
12000	22 x 30	2.20	2.53	0.062	0.053	ECOS1AA123BA		30 x 25	2.90	3.34	0.055	0.044	ECOS1CA123DA	
15000	22 x 35	2.30	2.65	0.053	0.045	ECOS1AA153BA	15000	22 x 40	3.20	3.68	0.046	0.037	ECOS1CA153BA	
	25 x 25	2.30	2.65	0.053	0.045	ECOS1AA153CA			25 x 35	3.20	3.68	0.046	0.037	ECOS1CA153CA
18000	22 x 40	2.40	2.76	0.044	0.038	ECOS1AA183BA		30 x 30	3.20	3.68	0.046	0.037	ECOS1CA153DA	
	25 x 30	2.40	2.76	0.044	0.038	ECOS1AA183CA	18000	22 x 45	3.50	4.03	0.040	0.034	ECOS1CA183BA	
22000	22 x 45	2.60	2.99	0.038	0.032	ECOS1AA223BA			25 x 40	3.50	4.03	0.040	0.034	ECOS1CA183CA
	25 x 35	2.60	2.99	0.038	0.032	ECOS1AA223CA		30 x 30	3.50	4.03	0.040	0.034	ECOS1CA183DA	
	30 x 25	2.60	2.99	0.038	0.032	ECOS1AA223DA		35 x 25	3.50	4.03	0.040	0.034	ECOS1CA183EA	
27000	22 x 50	3.10	3.57	0.033	0.028	ECOS1AA273BA	22000	25 x 45	3.80	4.37	0.033	0.028	ECOS1CA223CA	
	25 x 40	3.10	3.57	0.033	0.028	ECOS1AA273CA			30 x 35	3.80	4.37	0.033	0.028	ECOS1CA223DA
	30 x 30	3.10	3.57	0.033	0.028	ECOS1AA273DA			35 x 30	3.80	4.37	0.033	0.028	ECOS1CA223EA
	35 x 25	3.10	3.57	0.033	0.028	ECOS1AA273EA		27000	25 x 50	4.20	4.83	0.028	0.025	ECOS1CA273CA
33000	25 x 45	3.40	3.91	0.027	0.023	ECOS1AA333CA			30 x 40	4.20	4.83	0.028	0.025	ECOS1CA273DA
	30 x 35	3.40	3.91	0.027	0.023	ECOS1AA333DA			35 x 30	4.20	4.83	0.028	0.025	ECOS1CA273EA
	35 x 30	3.40	3.91	0.027	0.023	ECOS1AA333EA	33000	30 x 45	4.70	5.41	0.023	0.020	ECOS1CA333DA	
39000	25 x 50	3.70	4.26	0.025	0.021	ECOS1AA393CA			35 x 35	4.70	5.41	0.023	0.020	ECOS1CA333EA
	30 x 40	3.70	4.26	0.025	0.021	ECOS1AA393DA	39000	30 x 50	5.10	5.87	0.022	0.020	ECOS1CA393DA	
	35 x 30	3.70	4.26	0.025	0.021	ECOS1AA393EA			35 x 40	5.10	5.87	0.022	0.020	ECOS1CA393EA
47000	30 x 45	4.20	4.83	0.023	0.020	ECOS1AA473DA	47000	35 x 45	5.50	6.33	0.020	0.018	ECOS1CA473EA	
	35 x 35	4.20	4.83	0.023	0.020	ECOS1AA473EA	56000	35 x 50	6.00	6.90	0.019	0.017	ECOS1CA563EA	
56000	30 x 50	5.00	5.75	0.022	0.019	ECOS1AA563DA	<b>25 VDC Working, 32 VDC Surge</b>							
68000	35 x 40	5.00	5.75	0.022	0.021	ECOS1AA563EA	2200	22 x 20	1.30	1.50	0.241	0.181	ECOS1EA222BL	
ECOS1AA683EA								22 x 25	1.30	1.50	0.241	0.181	ECOS1EA222BA	
<b>16 VDC Working, 20 VDC Surge</b>							3300	22 x 25	1.62	1.86	0.161	0.121	ECOS1EA332BA	
3300	22 x 20	1.30	1.50	0.216	0.173	ECOS1CA332BL			25 x 20	1.60	1.84	0.161	0.121	ECOS1EA332CL
	22 x 25	1.30	1.50	0.176	0.141	ECOS1CA332BA	4700	22 x 25	2.00	2.30	0.106	0.079	ECOS1EA472BA	
4700	22 x 25	1.52	1.75	0.123	0.099	ECOS1CA472BA			30 x 20	1.80	2.07	0.113	0.085	ECOS1EA472DL
	25 x 20	1.60	1.84	0.152	0.121	ECOS1CA472CL	5600	22 x 30	2.20	2.53	0.089	0.067	ECOS1EA562BA	
6800	22 x 25	2.20	2.53	0.085	0.068	ECOS1CA682BA		6800	22 x 30	2.40	2.76	0.073	0.055	ECOS1EA682BA
	30 x 20	1.80	2.07	0.105	0.084	ECOS1CA682DL			25 x 25	2.40	2.76	0.073	0.055	ECOS1EA682CA
8200	22 x 30	2.40	2.76	0.071	0.057	ECOS1CA822BA		35 x 20	2.30	2.65	0.080	0.060	ECOS1EA682EL	
10000	22 x 30	2.60	2.99	0.066	0.053	ECOS1CA103BA	8200	22 x 35	2.70	3.11	0.061	0.045	ECOS1EA822BA	
	25 x 25	2.60	2.99	0.066	0.053	ECOS1CA103CA			25 x 30	2.70	3.11	0.061	0.045	ECOS1EA822CA





### TS-HA Standard Ratings (continued)

Cap. ( $\mu$ F)	Size (mm) D x L	Max 105°C R.C. ( $A_{rms}$ )		20°C ESR ( $\Omega$ , max.)		Panasonic Part Number
		120Hz	10kHz-	120Hz	20kHz	
<b>400 VDC Working, 450 VDC Surge</b>						
33	22 x 20	0.20	0.28	5.024	1.758	ECOS2GA330BL
	22 x 25	0.30	0.42	4.521	1.582	ECOS2GA330BA
47	22 x 25	0.43	0.60	2.822	0.988	ECOS2GA470BA
	25 x 20	0.25	0.35	3.527	1.235	ECOS2GA470CL
56	22 x 25	0.51	0.71	2.368	0.829	ECOS2GA560BA
68	22 x 30	0.56	0.78	1.950	0.683	ECOS2GA680BA
	25 x 25	0.56	0.78	1.950	0.683	ECOS2GA680CA
	30 x 20	0.35	0.49	2.438	0.853	ECOS2GA680DL
82	22 x 35	0.64	0.90	1.617	0.566	ECOS2GA820BA
	25 x 25	0.64	0.90	1.617	0.566	ECOS2GA820CA
100	22 x 35	0.69	0.97	1.326	0.464	ECOS2GA101BA
	25 x 30	0.69	0.97	1.326	0.464	ECOS2GA101CA
	35 x 20	0.47	0.66	1.658	0.580	ECOS2GA101EL
120	22 x 40	0.75	1.05	1.105	0.387	ECOS2GA121BA
	25 x 35	0.75	1.05	1.105	0.387	ECOS2GA121CA
	30 x 25	0.75	1.05	1.105	0.387	ECOS2GA121DA
150	22 x 50	0.82	1.15	0.884	0.309	ECOS2GA151BA
	25 x 40	0.82	1.15	0.884	0.309	ECOS2GA151CA
	30 x 30	0.82	1.15	0.884	0.309	ECOS2GA151DA
180	25 x 45	0.95	1.33	0.737	0.258	ECOS2GA181CA
	30 x 35	0.95	1.33	0.737	0.258	ECOS2GA181DA
	35 x 25	0.95	1.33	0.737	0.258	ECOS2GA181EA
220	25 x 50	1.10	1.54	0.603	0.211	ECOS2GA221CA
	30 x 40	1.10	1.54	0.603	0.211	ECOS2GA221DA
	35 x 30	1.10	1.54	0.603	0.211	ECOS2GA221EA
270	30 x 45	1.20	1.68	0.491	0.172	ECOS2GA271DA
	35 x 35	1.20	1.68	0.491	0.172	ECOS2GA271EA
330	30 x 50	1.35	1.89	0.402	0.161	ECOS2GA331DA
	35 x 40	1.35	1.89	0.402	0.161	ECOS2GA331EA
390	35 x 45	1.55	2.17	0.340	0.136	ECOS2GA391EA
470	35 x 50	1.75	2.45	0.282	0.127	ECOS2GA471EA
<b>450 VDC Working, 500 VDC Surge</b>						
56	22 x 25	0.40	0.56	2.368	0.947	ECOS2WA560BA
68	22 x 30	0.50	0.70	1.950	0.780	ECOS2WA680BA
	25 x 25	0.50	0.70	1.950	0.780	ECOS2WA680CA
82	22 x 35	0.56	0.78	1.617	0.647	ECOS2WA820BA
100	22 x 40	0.64	0.90	1.326	0.531	ECOS2WA101BA
	25 x 30	0.64	0.90	1.326	0.531	ECOS2WA101CA
	30 x 25	0.64	0.90	1.326	0.531	ECOS2WA101DA
120	22 x 45	0.72	1.01	1.105	0.442	ECOS2WA121BA
	25 x 35	0.72	1.01	1.105	0.442	ECOS2WA121CA
150	22 x 50	0.79	1.11	0.884	0.354	ECOS2WA151BA
	25 x 40	0.79	1.11	0.884	0.354	ECOS2WA151CA
	30 x 30	0.79	1.11	0.884	0.354	ECOS2WA151DA
	35 x 25	0.79	1.11	0.884	0.354	ECOS2WA151EA
180	25 x 45	0.87	1.22	0.737	0.295	ECOS2WA181CA
	30 x 35	0.87	1.22	0.737	0.295	ECOS2WA181DA
220	25 x 50	1.00	1.40	0.678	0.271	ECOS2WA221CA
	30 x 40	1.00	1.40	0.678	0.271	ECOS2WA221DA
	35 x 30	1.00	1.40	0.678	0.271	ECOS2WA221EA
270	30 x 45	1.17	1.64	0.614	0.246	ECOS2WA271DA
	35 x 35	1.17	1.64	0.614	0.246	ECOS2WA271EA
330	30 x 50	1.38	1.93	0.502	0.201	ECOS2WA331DA
	35 x 40	1.38	1.93	0.502	0.201	ECOS2WA331EA
390	35 x 50	1.55	2.17	0.425	0.170	ECOS2WA391EA