

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 _{rms})		20°C ESR (Ω, max.)		Panasonic Part Number	Cap. (µF)	Size (mm) D x L	Max 105°C R.C. (A _{rms})		20°C ESR (Ω, max.)		Panasonic Part Number
		120Hz	10kHz-	120Hz	20kHz				120Hz	20kHz	120Hz	20kHz	
10 VDC Working, 13 VDC Surge							16 VDC Working, 20 VDC Surge (continued)						
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
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	25 VDC Working, 32 VDC Surge						
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
16 VDC Working, 20 VDC Surge							2200	22 x 25	1.30	1.50	0.241	0.181	ECOS1EA222BA
3300	22 x 20	1.30	1.50	0.216	0.173	ECOS1CA332BL	3300	22 x 25	1.62	1.86	0.161	0.121	ECOS1EA332BA
	22 x 25	1.30	1.50	0.176	0.141	ECOS1CA332BA		25 x 20	1.60	1.84	0.161	0.121	ECOS1EA332CL
4700	22 x 25	1.52	1.75	0.123	0.099	ECOS1CA472BA	4700	22 x 25	2.00	2.30	0.106	0.079	ECOS1EA472BA
	25 x 20	1.60	1.84	0.152	0.121	ECOS1CA472CL		30 x 20	1.80	2.07	0.113	0.085	ECOS1EA472DL
6800	22 x 25	2.20	2.53	0.085	0.068	ECOS1CA682BA	5600	22 x 30	2.20	2.53	0.089	0.067	ECOS1EA562BA
	30 x 20	1.80	2.07	0.105	0.084	ECOS1CA682DL	6800	22 x 30	2.40	2.76	0.073	0.055	ECOS1EA682BA
8200	22 x 30	2.40	2.76	0.071	0.057	ECOS1CA822BA		25 x 25	2.40	2.76	0.073	0.055	ECOS1EA682CA
10000	22 x 30	2.60	2.99	0.066	0.053	ECOS1CA103BA		35 x 20	2.30	2.65	0.080	0.060	ECOS1EA682EL
	25 x 25	2.60	2.99	0.066	0.053	ECOS1CA103CA	8200	22 x 35	2.70	3.11	0.061	0.045	ECOS1EA822BA
								25 x 30	2.70	3.11	0.061	0.045	ECOS1EA822CA

TS-HA Standard Ratings (continued)

Cap. (μF)	Size (mm) D x L	Max 105°C R.C. (A _{rms})		20°C ESR (Ω, max.)		Panasonic Part Number
		120Hz	10kHz-	120Hz	20kHz	
100 VDC Working, 125 VDC Surge (continued)						
470	22 x 25 25 x 20	0.92 1.00	1.38 1.50	0.388 0.459	0.233 0.275	ECOS2AA471BA ECOS2AA471CL
560	22 x 25	1.10	1.65	0.296	0.178	ECOS2AA561BA
680	30 x 20	1.10	1.65	0.317	0.190	ECOS2AA681DL
820	22 x 30 25 x 25	1.40 1.40	2.10 2.10	0.202 0.202	0.121 0.121	ECOS2AA821BA ECOS2AA821CA
1000	22 x 35 25 x 30 35 x 20	1.70 1.70 1.20	2.55 2.55 1.80	0.182 0.182 0.216	0.109 0.109 0.129	ECOS2AA102BA ECOS2AA102CA ECOS2AA102EL
1200	22 x 40 25 x 35 30 x 25	1.80 1.80 1.80	2.70 2.70 2.70	0.152 0.152 0.152	0.091 0.091 0.091	ECOS2AA122BA ECOS2AA122CA ECOS2AA122DA
1500	22 x 45 25 x 40 30 x 30 35 x 25	2.10 2.10 2.10 2.10	3.15 3.15 3.15 3.15	0.122 0.122 0.122 0.122	0.073 0.079 0.079 0.079	ECOS2AA152BA ECOS2AA152CA ECOS2AA152DA ECOS2AA152EA
1800	25 x 45 30 x 35 35 x 30	2.30 2.30 2.30	3.45 3.45 3.45	0.111 0.111 0.111	0.072 0.072 0.072	ECOS2AA182CA ECOS2AA182DA ECOS2AA182EA
2200	25 x 50 30 x 40 35 x 30	2.60 2.60 2.60	3.90 3.90 3.90	0.090 0.090 0.090	0.059 0.059 0.059	ECOS2AA222CA ECOS2AA222DA ECOS2AA222EA
2700	30 x 45 35 x 35	2.90 2.90	4.35 4.35	0.080 0.080	0.052 0.052	ECOS2AA272DA ECOS2AA272EA
3300	30 x 50 35 x 40	3.20 3.20	4.80 4.80	0.075 0.075	0.053 0.053	ECOS2AA332DA ECOS2AA332EA
3900	35 x 45	3.60	5.40	0.064	0.045	ECOS2AA392EA
4700	35 x 50	3.80	5.70	0.053	0.040	ECOS2AA472EA
160 VDC Working, 200 VDC Surge						
150	22 x 20 22 x 25	0.55 0.61	0.77 0.85	1.437 1.216	0.647 0.547	ECOS2CA151BL ECOS2CA151BA
220	22 x 25 25 x 20	0.90 0.75	1.26 1.05	0.829 0.980	0.373 0.441	ECOS2CA221BA ECOS2CA221CL
270	22 x 25	1.10	1.54	0.675	0.304	ECOS2CA271BA
330	22 x 30 30 x 20	1.20 1.00	1.68 1.40	0.553 0.553	0.249 0.249	ECOS2CA331BA ECOS2CA331DL
390	22 x 30 25 x 25	1.30 1.30	1.82 1.82	0.553 0.553	0.249 0.249	ECOS2CA391BA ECOS2CA391CA
470	22 x 35 25 x 30 35 x 20	1.40 1.40 1.15	1.96 1.96 1.61	0.529 0.459 0.459	0.238 0.206 0.206	ECOS2CA471BA ECOS2CA471CA ECOS2CA471EL
560	22 x 40 25 x 30 30 x 25	1.50 1.50 1.50	2.10 2.10 2.10	0.385 0.385 0.385	0.173 0.173 0.173	ECOS2CA561BA ECOS2CA561CA ECOS2CA561DA
680	22 x 45 25 x 35 30 x 30	1.70 1.70 1.70	2.38 2.38 2.38	0.317 0.317 0.317	0.143 0.143 0.143	ECOS2CA681BA ECOS2CA681CA ECOS2CA681DA
820	25 x 40 30 x 30	2.00 2.00	2.80 2.80	0.263 0.263	0.118 0.118	ECOS2CA821CA ECOS2CA821DA
1000	25 x 45 30 x 35	2.20 2.20	3.08 3.08	0.216 0.216	0.108 0.108	ECOS2CA102CA ECOS2CA102DA
1200	25 x 50 30 x 40	2.30 2.30	3.22 3.22	0.180 0.180	0.090 0.090	ECOS2CA122CA ECOS2CA122DA
1500	30 x 45 35 x 35	2.50 2.50	3.50 3.50	0.166 0.166	0.083 0.083	ECOS2CA152DA ECOS2CA152EA
1800	30 x 50 35 x 40	2.70 2.70	3.78 3.78	0.138 0.138	0.083 0.069	ECOS2CA182DA ECOS2CA182EA
2200	35 x 50	2.90	4.06	0.113	0.057	ECOS2CA222EA
200 VDC Working, 250 VDC Surge						
100	22 x 20 22 x 25	0.50 0.50	0.70 0.70	1.989 1.658	0.895 0.746	ECOS2DA101BL ECOS2DA101BA
150	22 x 25 25 x 20	0.68 0.65	0.95 0.91	1.105 1.326	0.497 0.597	ECOS2DA151BA ECOS2DA151CL
220	22 x 25 30 x 20	1.00 0.87	1.40 1.22	0.754 0.904	0.339 0.407	ECOS2DA221BA ECOS2DA221DL
270	22 x 30 25 x 25	1.10 1.10	1.54 1.54	0.614 0.614	0.276 0.276	ECOS2DA271BA ECOS2DA271CA
330	22 x 30 25 x 25 35 x 20	1.20 1.20 1.10	1.68 1.68 1.54	0.502 0.502 0.603	0.226 0.226 0.271	ECOS2DA331BA ECOS2DA331CA ECOS2DA331EL
390	22 x 35 25 x 30 30 x 25	1.30 1.30 1.30	1.82 1.82 1.82	0.425 0.425 0.425	0.191 0.191 0.191	ECOS2DA391BA ECOS2DA391CA ECOS2DA391DA
470	22 x 40 25 x 35 30 x 25	1.40 1.40 1.40	1.96 1.96 1.96	0.353 0.353 0.353	0.159 0.159 0.159	ECOS2DA471BA ECOS2DA471CA ECOS2DA471DA
250 VDC Working, 300 VDC Surge						
68	22 x 20 22 x 25	0.40 0.40	0.56 0.56	2.926 2.438	1.463 1.219	ECOS2EA680BL ECOS2EA680BA
100	22 x 25 25 x 20	0.55 0.50	0.77 0.70	1.658 1.989	0.829 0.995	ECOS2EA101BA ECOS2EA101CL
150	22 x 25 30 x 20	0.75 0.65	1.05 0.91	1.105 1.326	0.553 0.663	ECOS2EA151BA ECOS2EA151DL
180	22 x 30 25 x 25	0.90 0.90	1.26 1.26	0.921 0.921	0.461 0.461	ECOS2EA181BA ECOS2EA181CA
220	22 x 30 25 x 25 35 x 20	1.00 1.00 0.87	1.40 1.40 1.22	0.754 0.754 0.904	0.377 0.377 0.452	ECOS2EA221BA ECOS2EA221CA ECOS2EA221EL
270	22 x 35 25 x 30 30 x 25	1.10 1.10 1.10	1.54 1.54 1.54	0.614 0.614 0.614	0.307 0.307 0.307	ECOS2EA271BA ECOS2EA271CA ECOS2EA271DA
330	22 x 40 25 x 35 30 x 25	1.20 1.20 1.20	1.68 1.68 1.68	0.502 0.502 0.502	0.251 0.251 0.251	ECOS2EA331BA ECOS2EA331CA ECOS2EA331DA
390	22 x 45 25 x 35 30 x 30	1.30 1.30 1.30	1.82 1.82 1.82	0.425 0.425 0.425	0.213 0.213 0.213	ECOS2EA391BA ECOS2EA391CA ECOS2EA391DA
470	25 x 45 30 x 35 35 x 30	1.40 1.40 1.40	1.96 1.96 1.96	0.353 0.353 0.353	0.176 0.176 0.176	ECOS2EA471CA ECOS2EA471DA ECOS2EA471EA
560	25 x 50 30 x 35 35 x 30	1.50 1.50 1.50	2.10 2.10 2.10	0.296 0.296 0.296	0.148 0.148 0.148	ECOS2EA561CA ECOS2EA561DA ECOS2EA561EA
680	30 x 45 35 x 35	1.70 1.70	2.38 2.38	0.244 0.244	0.122 0.122	ECOS2EA681DA ECOS2EA681EA
820	30 x 50 35 x 40	2.00 2.00	2.80 2.80	0.202 0.202	0.101 0.101	ECOS2EA821DA ECOS2EA821EA
1000	35 x 45	2.20	3.08	0.199	0.099	ECOS2EA102EA
1200	35 x 50	2.30	3.22	0.166	0.083	ECOS2EA122EA
385 VDC Working, 435 VDC Surge						
33	22 x 20	0.20	0.28	5.024	1.758	ECOS2TA330BL
47	25 x 20	0.25	0.35	3.527	1.235	ECOS2TA470CL
56	22 x 25	0.51	0.71	2.368	0.829	ECOS2TA560BA
68	22 x 30 25 x 25 30 x 20	0.56 0.56 0.35	0.78 0.78 0.49	1.950 1.950 2.438	0.683 0.683 0.853	ECOS2TA680BA ECOS2TA680CA ECOS2TA680DL
82	22 x 35 25 x 25	0.64 0.64	0.90 0.90	1.617 1.617	0.566 0.566	ECOS2TA820BA ECOS2TA820CA
100	22 x 35 25 x 30 35 x 20	0.69 0.69 0.47	0.97 0.97 0.66	1.326 1.326 1.658	0.464 0.464 0.580	ECOS2TA101BA ECOS2TA101CA ECOS2TA101EL
120	22 x 35 25 x 30	0.75 0.75	1.05 1.05	1.105 1.105	0.387 0.387	ECOS2TA121BA ECOS2TA121CA
150	22 x 50 25 x 40 30 x 30	0.82 0.82 0.82	1.15 1.15 1.15	0.884 0.884 0.884	0.309 0.309 0.309	ECOS2TA151BA ECOS2TA151CA ECOS2TA151DA
180	25 x 45 30 x 35 35 x 25	0.95 0.95 0.95	1.33 1.33 1.33	0.737 0.737 0.737	0.258 0.258 0.258	ECOS2TA181CA ECOS2TA181DA ECOS2TA181EA
220	25 x 50 30 x 40 35 x 30	1.10 1.10 1.10	1.54 1.54 1.54	0.603 0.603 0.603	0.211 0.211 0.211	ECOS2TA221CA ECOS2TA221DA ECOS2TA221EA
270	30 x 45 35 x 35	1.20 1.20	1.68 1.68	0.491 0.491	0.172 0.172	ECOS2TA271DA ECOS2TA271EA
330	30 x 50 35 x 40	1.35 1.35	1.89 1.89	0.402 0.402	0.161 0.161	ECOS2TA331DA ECOS2TA331EA
390	35 x 45	1.55	2.17	0.340	0.136	ECOS2TA391EA
470	35 x 50	1.75	2.45	0.282	0.127	ECOS2TA471EA

TS-HA Standard Ratings (continued)

Cap. (μ F)	Size (mm) D x L	Max 105°C R.C. (A_{rms})		20°C ESR (Ω , max.)		Panasonic Part Number
		120Hz	10kHz-	120Hz	20kHz	
400 VDC Working, 450 VDC Surge						
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
450 VDC Working, 500 VDC Surge						
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