

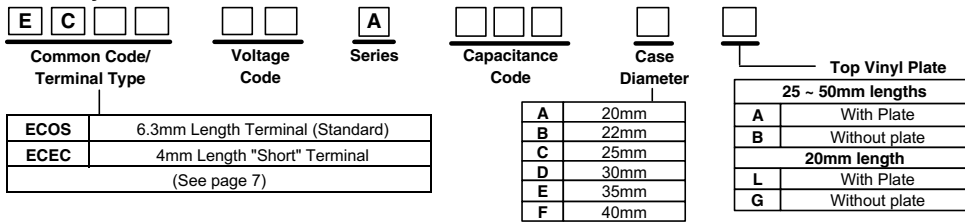
## TS-HA Series two terminal snap-in

- 3000 hour\* life at 105°C with high ripple current capability
- Wide range of case sizes including 20mm, low profile lengths
- **NEW:** 40mm diameter sizes through 100WV.
- Can vent construction



Rated Working Voltage:	10 ~ 250 VDC	385 ~ 450 VDC
Operating Temperature:	-40 ~ +105°C	-25 ~ +105°C
Nominal Capacitance:	68 ~ 68000µF (±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: $\frac{(\text{rated cap. } [\mu\text{F}] - 33000)}{1000}$		
Endurance:	3000 hours* at +105°C with maximum specified ripple current (see page 4) *2000 hours for 20mm diameter or 20mm length sizes	

### Part Number System



Ripple Current  
Multipliers:  
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### TS-HA Standard Ratings

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	10k~100kHz	120Hz	20kHz				120Hz	10k~100kHz	120Hz	20kHz	
<b>10 VDC Working, 13 VDC Surge</b>							<b>16 VDC Working, 20 VDC Surge</b>						
6800	20 x 25	1.30	1.50	0.110	0.093	ECOS1AA682AA	6800	20 x 30	2.20	2.53	0.085	0.068	ECOS1CA682AA
8200	20 x 30	1.60	1.84	0.091	0.077	ECOS1AA822AA	8200	20 x 35	2.40	2.76	0.071	0.057	ECOS1CA822AA
10000	20 x 30	1.80	2.07	0.075	0.063	ECOS1AA103AA	10000	20 x 40	2.60	2.99	0.066	0.053	ECOS1CA103AA
12000	20 x 35	2.20	2.53	0.062	0.053	ECOS1AA123AA	3300	22 x 20	1.30	1.50	0.216	0.173	ECOS1CA332BL
15000	20 x 40	2.30	2.65	0.053	0.045	ECOS1AA153AA	3300	22 x 25	1.30	1.50	0.176	0.141	ECOS1CA332BA
4700	22 x 25	0.85	0.98	0.159	0.135	ECOS1AA472BA	4700	22 x 25	1.52	1.75	0.123	0.099	ECOS1CA472BA
6800	22 x 25	1.30	1.50	0.110	0.093	ECOS1AA682BA	6800	22 x 25	2.20	2.53	0.085	0.068	ECOS1CA682BA
10000	22 x 25	1.80	2.07	0.075	0.063	ECOS1AA103BA	8200	22 x 30	2.40	2.76	0.071	0.057	ECOS1CA822BA
12000	22 x 30	2.20	2.53	0.062	0.053	ECOS1AA123BA	10000	22 x 30	2.60	2.99	0.066	0.053	ECOS1CA103BA
15000	22 x 35	2.30	2.65	0.053	0.045	ECOS1AA153BA	12000	22 x 35	2.90	3.34	0.055	0.044	ECOS1CA123BA
18000	22 x 40	2.40	2.76	0.044	0.038	ECOS1AA183BA	15000	22 x 40	3.20	3.68	0.046	0.037	ECOS1CA153BA
22000	22 x 45	2.60	2.99	0.038	0.032	ECOS1AA223BA	18000	22 x 45	3.50	4.03	0.040	0.034	ECOS1CA183BA
27000	22 x 50	3.10	3.57	0.033	0.028	ECOS1AA273BA	4700	25 x 20	1.60	1.84	0.152	0.121	ECOS1CA472CL
15000	25 x 25	2.30	2.65	0.053	0.045	ECOS1AA153CA	10000	25 x 25	2.60	2.99	0.066	0.053	ECOS1CA103CA
18000	25 x 30	2.40	2.76	0.044	0.038	ECOS1AA183CA	12000	25 x 30	2.90	3.34	0.055	0.044	ECOS1CA123CA
22000	25 x 35	2.60	2.99	0.038	0.032	ECOS1AA223CA	15000	25 x 35	3.20	3.68	0.046	0.037	ECOS1CA153CA
27000	25 x 40	3.10	3.57	0.033	0.028	ECOS1AA273CA	18000	25 x 40	3.50	4.03	0.040	0.034	ECOS1CA183CA
33000	25 x 45	3.40	3.91	0.027	0.023	ECOS1AA333CA	22000	25 x 45	3.80	4.37	0.033	0.028	ECOS1CA223CA
39000	25 x 50	3.70	4.26	0.025	0.021	ECOS1AA393CA	27000	25 x 50	4.20	4.83	0.028	0.025	ECOS1CA273CA
22000	30 x 25	2.60	2.99	0.038	0.032	ECOS1AA223DA	6800	30 x 20	1.80	2.07	0.105	0.084	ECOS1CA682DL
27000	30 x 30	3.10	3.57	0.033	0.028	ECOS1AA273DA	12000	30 x 25	2.90	3.34	0.055	0.044	ECOS1CA123DA
33000	30 x 35	3.40	3.91	0.027	0.023	ECOS1AA333DA	15000	30 x 30	3.20	3.68	0.046	0.037	ECOS1CA153DA
39000	30 x 40	3.70	4.26	0.025	0.021	ECOS1AA393DA	18000	30 x 30	3.50	4.03	0.040	0.034	ECOS1CA183DA
47000	30 x 45	4.20	4.83	0.023	0.020	ECOS1AA473DA	22000	30 x 35	3.80	4.37	0.033	0.028	ECOS1CA223DA
56000	30 x 50	5.00	5.75	0.022	0.019	ECOS1AA563DA	27000	30 x 40	4.20	4.83	0.028	0.025	ECOS1CA273DA
27000	35 x 25	3.10	3.57	0.033	0.028	ECOS1AA273EA	33000	30 x 45	4.70	5.41	0.023	0.020	ECOS1CA333DA
33000	35 x 30	3.40	3.91	0.027	0.023	ECOS1AA333EA	39000	30 x 50	5.10	5.87	0.022	0.020	ECOS1CA393DA
39000	35 x 30	3.70	4.26	0.025	0.021	ECOS1AA393EA	10000	35 x 20	2.40	2.76	0.071	0.057	ECOS1CA103EL
47000	35 x 35	4.20	4.83	0.023	0.020	ECOS1AA473EA	18000	35 x 25	3.50	4.03	0.040	0.034	ECOS1CA183EA
56000	35 x 40	5.00	5.75	0.022	0.021	ECOS1AA563EA	22000	35 x 30	3.80	4.37	0.033	0.028	ECOS1CA223EA
68000	35 x 50	5.50	6.33	0.021	0.020	ECOS1AA683EA	27000	35 x 30	4.20	4.83	0.028	0.025	ECOS1CA273EA
62000	40 x 40	5.42	6.23	0.023	0.022	ECOS1AA623FA	33000	35 x 35	4.70	5.41	0.023	0.020	ECOS1CA333EA
82000	40 x 50	7.36	8.46	0.018	0.017	ECOS1AA823FA	39000	35 x 40	5.10	5.87	0.022	0.020	ECOS1CA393EA
							47000	35 x 45	5.50	6.33	0.020	0.018	ECOS1CA473EA
							56000	35 x 50	6.00	6.90	0.019	0.017	ECOS1CA563EA
							47000	40 x 40	5.50	6.33	0.020	0.018	ECOS1CA473FA
							68000	40 x 50	7.29	8.38	0.015	0.014	ECOS1CA683FA

### 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	Cap. ( $\mu$ F)	Size (mm) D x L	Max 105°C R.C. ( $A_{rms}$ )		20°C ESR ( $\Omega$ , max.)		Panasonic Part Number
		120Hz	10k~100kHz	120Hz	20kHz				120Hz	10k~100kHz	120Hz	20kHz	
<b>25 VDC Working, 32 VDC Surge</b>							<b>35 VDC Working, 44 VDC Surge</b>						
4700	20 x 30	2.00	2.30	0.106	0.079	ECOS1EA472AA	3300	20 x 30	1.90	2.19	0.121	0.090	ECOS1VA332AA
5600	20 x 35	2.20	2.53	0.089	0.067	ECOS1EA562AA	3900	20 x 35	2.00	2.30	0.111	0.083	ECOS1VA392AA
6800	20 x 40	2.40	2.76	0.073	0.055	ECOS1EA682AA	4700	20 x 40	2.20	2.53	0.088	0.066	ECOS1VA472AA
2200	22 x 20	1.30	1.50	0.241	0.181	ECOS1EA222BL	1500	22 x 20	1.10	1.27	0.287	0.216	ECOS1VA152BL
2200	22 x 25	1.30	1.50	0.241	0.181	ECOS1EA222BA	1500	22 x 25	1.10	1.27	0.287	0.216	ECOS1VA152BA
3300	22 x 25	1.62	1.86	0.161	0.121	ECOS1EA332BA	2200	22 x 25	1.48	1.70	0.196	0.147	ECOS1VA222BA
4700	22 x 25	2.00	2.30	0.106	0.079	ECOS1EA472BA	3300	22 x 25	1.90	2.19	0.121	0.090	ECOS1VA332BA
5600	22 x 30	2.20	2.53	0.089	0.067	ECOS1EA562BA	3900	22 x 30	2.00	2.30	0.111	0.083	ECOS1VA392BA
6800	22 x 30	2.40	2.76	0.073	0.055	ECOS1EA682BA	4700	22 x 35	2.20	2.53	0.088	0.066	ECOS1VA472BA
8200	22 x 35	2.70	3.11	0.061	0.045	ECOS1EA822BA	5600	22 x 35	2.40	2.76	0.074	0.056	ECOS1VA562BA
10000	22 x 40	3.00	3.45	0.051	0.039	ECOS1EA103BA	6800	22 x 40	2.60	2.99	0.061	0.046	ECOS1VA682BA
12000	22 x 45	3.20	3.68	0.044	0.033	ECOS1EA123BA	8200	22 x 50	2.90	3.34	0.051	0.038	ECOS1VA822BA
3300	25 x 20	1.60	1.84	0.161	0.121	ECOS1EA332CL	2200	25 x 20	1.40	1.61	0.196	0.147	ECOS1VA222CL
6800	25 x 25	2.40	2.76	0.073	0.055	ECOS1EA682CA	4700	25 x 25	2.20	2.53	0.088	0.066	ECOS1VA472CA
8200	25 x 30	2.70	3.11	0.061	0.045	ECOS1EA822CA	5600	25 x 30	2.40	2.76	0.074	0.056	ECOS1VA562CA
10000	25 x 35	3.00	3.45	0.051	0.039	ECOS1EA103CA	6800	25 x 35	2.60	2.99	0.061	0.046	ECOS1VA682CA
12000	25 x 40	3.20	3.68	0.044	0.035	ECOS1EA123CA	8200	25 x 40	2.90	3.34	0.051	0.038	ECOS1VA822CA
15000	25 x 45	3.60	4.14	0.036	0.031	ECOS1EA153CA	10000	25 x 45	3.20	3.68	0.041	0.031	ECOS1VA103CA
18000	25 x 50	3.90	4.49	0.030	0.027	ECOS1EA183CA	12000	25 x 50	3.50	4.03	0.035	0.026	ECOS1VA123CA
4700	30 x 20	1.80	2.07	0.113	0.085	ECOS1EA472DL	3300	30 x 20	1.70	1.96	0.131	0.098	ECOS1VA332DL
8200	30 x 25	2.70	3.11	0.061	0.045	ECOS1EA822DA	5600	30 x 25	2.40	2.76	0.074	0.056	ECOS1VA562DA
10000	30 x 30	3.00	3.45	0.051	0.039	ECOS1EA103DA	6800	30 x 30	2.60	2.99	0.061	0.046	ECOS1VA682DA
12000	30 x 30	3.20	3.68	0.044	0.035	ECOS1EA123DA	8200	30 x 30	2.90	3.34	0.051	0.038	ECOS1VA822DA
15000	30 x 35	3.60	4.14	0.036	0.031	ECOS1EA153DA	10000	30 x 35	3.20	3.68	0.041	0.031	ECOS1VA103DA
18000	30 x 40	3.90	4.49	0.030	0.027	ECOS1EA183DA	12000	30 x 40	3.50	4.03	0.035	0.026	ECOS1VA123DA
22000	30 x 45	4.30	4.95	0.025	0.022	ECOS1EA223DA	15000	30 x 45	3.90	4.49	0.030	0.022	ECOS1VA153DA
6800	35 x 20	2.30	2.65	0.080	0.060	ECOS1EA682EL	4700	35 x 20	2.00	2.30	0.095	0.071	ECOS1VA472EL
12000	35 x 25	3.20	3.68	0.044	0.035	ECOS1EA123EA	8200	35 x 25	2.90	3.34	0.051	0.038	ECOS1VA822EA
15000	35 x 30	3.60	4.14	0.036	0.031	ECOS1EA153EA	10000	35 x 30	3.20	3.68	0.041	0.031	ECOS1VA103EA
18000	35 x 35	3.90	4.49	0.030	0.027	ECOS1EA183EA	12000	35 x 30	3.50	4.03	0.035	0.026	ECOS1VA123EA
22000	35 x 35	4.30	4.95	0.025	0.022	ECOS1EA223EA	15000	35 x 35	3.90	4.49	0.030	0.022	ECOS1VA153EA
27000	35 x 45	4.80	5.52	0.021	0.019	ECOS1EA273EA	18000	35 x 40	4.30	4.95	0.028	0.021	ECOS1VA183EA
33000	35 x 50	5.50	6.33	0.018	0.016	ECOS1EA333EA	22000	35 x 50	5.00	5.75	0.023	0.017	ECOS1VA223EA
33000	40 x 40	5.50	6.33	0.018	0.016	ECOS1EA333FA	22000	40 x 40	5.00	5.75	0.023	0.017	ECOS1VA223FA
47000	40 x 50	6.47	7.44	0.015	0.014	ECOS1EA473FA	27000	40 x 50	5.44	6.26	0.020	0.015	ECOS1VA273FA
<b>50 VDC Working, 63 VDC Surge</b>							<b>63 VDC Working, 79 VDC Surge</b>						
1800	20 x 30	1.50	1.73	0.129	0.097	ECOS1HA182AA	1200	20 x 30	1.40	1.61	0.235	0.176	ECOS1JA122AA
2200	20 x 35	1.70	1.96	0.105	0.079	ECOS1HA222AA	1500	20 x 35	1.50	1.73	0.188	0.141	ECOS1JA152AA
2700	20 x 40	1.80	2.07	0.086	0.064	ECOS1HA272AA	1800	20 x 40	1.70	1.96	0.157	0.117	ECOS1JA182AA
1000	22 x 20	0.90	1.04	0.265	0.199	ECOS1HA102BL	680	22 x 20	0.90	1.04	0.463	0.347	ECOS1JA681BL
1000	22 x 25	0.90	1.04	0.232	0.174	ECOS1HA102BA	680	22 x 25	0.90	1.04	0.414	0.311	ECOS1JA681BA
1500	22 x 25	1.25	1.44	0.155	0.116	ECOS1HA152BA	1000	22 x 25	1.17	1.35	0.282	0.211	ECOS1JA102BA
1800	22 x 25	1.50	1.73	0.129	0.097	ECOS1HA182BA	1200	22 x 25	1.40	1.61	0.235	0.176	ECOS1JA122BA
2200	22 x 30	1.70	1.96	0.105	0.079	ECOS1HA222BA	1500	22 x 30	1.50	1.73	0.188	0.141	ECOS1JA152BA
2700	22 x 30	1.80	2.07	0.086	0.064	ECOS1HA272BA	1800	22 x 30	1.70	1.96	0.157	0.117	ECOS1JA182BA
3300	22 x 35	2.00	2.30	0.070	0.053	ECOS1HA332BA	2200	22 x 35	2.00	2.30	0.128	0.096	ECOS1JA222BA
3900	22 x 40	2.20	2.53	0.064	0.048	ECOS1HA392BA	2700	22 x 40	2.20	2.53	0.104	0.078	ECOS1JA272BA
4700	22 x 45	2.50	2.88	0.053	0.040	ECOS1HA472BA	3300	22 x 50	2.50	2.88	0.090	0.068	ECOS1JA332BA
5600	22 x 50	2.80	3.22	0.050	0.038	ECOS1HA562BA	1000	25 x 20	1.20	1.38	0.315	0.236	ECOS1JA102CL
1500	25 x 20	1.20	1.38	0.177	0.133	ECOS1HA152CL	1800	25 x 25	1.70	1.96	0.157	0.117	ECOS1JA182CA
2700	25 x 25	1.80	2.07	0.086	0.064	ECOS1HA272CA	2200	25 x 30	2.00	2.30	0.128	0.096	ECOS1JA222CA
3300	25 x 30	2.00	2.30	0.070	0.053	ECOS1HA332CA	2700	25 x 35	2.20	2.53	0.104	0.078	ECOS1JA272CA
3900	25 x 35	2.20	2.53	0.064	0.048	ECOS1HA392CA	3300	25 x 40	2.50	2.88	0.090	0.068	ECOS1JA332CA
4700	25 x 40	2.50	2.88	0.053	0.040	ECOS1HA472CA	3900	25 x 45	2.70	3.11	0.077	0.057	ECOS1JA392CA
5600	25 x 40	2.80	3.22	0.050	0.038	ECOS1HA562CA	4700	25 x 50	3.00	3.45	0.063	0.048	ECOS1JA472CA
6800	25 x 50	3.30	3.80	0.046	0.035	ECOS1HA682CA	1500	30 x 20	1.30	1.50	0.210	0.157	ECOS1JA152DL
2200	30 x 20	1.40	1.61	0.121	0.090	ECOS1HA222DL	2700	30 x 25	2.20	2.53	0.104	0.078	ECOS1JA272DA
3900	30 x 25	2.20	2.53	0.064	0.048	ECOS1HA392DA	3300	30 x 30	2.50	2.88	0.090	0.068	ECOS1JA332DA
4700	30 x 30	2.50	2.88	0.053	0.040	ECOS1HA472DA	3900	30 x 35	2.70	3.11	0.077	0.057	ECOS1JA392DA
5600	30 x 35	2.80	3.22	0.050	0.038	ECOS1HA562DA	4700	30 x 40	3.00	3.45	0.063	0.048	ECOS1JA472DA
6800	30 x 40	3.30	3.80	0.046	0.035	ECOS1HA682DA	5600	30 x 45	3.30	3.80	0.053	0.040	ECOS1JA562DA
8200	30 x 45	3.60	4.14	0.038	0.029	ECOS1HA822DA	6800	30 x 50	3.60	4.14	0.049	0.037	ECOS1JA682DA
10000	30 x 50	4.00	4.60	0.033	0.025	ECOS1HA103DA	2200	35 x 20	1.50	1.73	0.143	0.107	ECOS1JA222EL
3300	35 x 20	1.70	1.96	0.085	0.064	ECOS1HA332EL	3300	35 x 25	2.50	2.88	0.090	0.068	ECOS1JA332EA
4700	35 x 25	2.50	2.88	0.053	0.040	ECOS1HA472EA	3900	35 x 30	2.70	3.11	0.077	0.057	ECOS1JA392EA
5600	35 x 30	2.80	3.22	0.050	0.038	ECOS1HA562EA	4700	35 x 30	3.00	3.45	0.063	0.048	ECOS1JA472EA
6800	35 x 30	3.30	3.80	0.046	0.035	ECOS1HA682EA	5600	35 x 35	3.30	3.80	0.053	0.040	ECOS1JA562EA
8200	35 x 35	3.60	4.14	0.038	0.029	ECOS1HA822EA	6800	35 x 40	3.60	4.14	0.049	0.037	ECOS1JA682EA
10000	35 x 40	4.00	4.60	0.033	0.025	ECOS1HA103EA	8200	35 x 45	3.90	4.49	0.040	0.030	ECOS1JA822EA
12000	35 x 45	4.50	5.18	0.028	0.022	ECOS1HA123EA	10000	35 x 50	4.40	5.06	0.033	0.028	ECOS1JA103EA
15000	35 x 50	4.80	5.52	0.022	0.018	ECOS1HA153EA	12000	40 x 40	4.52	5.20	0.030	0.026	ECOS1JA123FA
15000	40 x 40	4.80	5.52	0.022	0.018	ECOS1HA153FA	15000	40 x 50	4.80	5.52	0.027	0.023	ECOS1JA153FA
22000	40 x 50	5.15	5.92	0.016	0.013	ECOS1HA223FA							

### 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	Cap. ( $\mu$ F)	Size (mm) D x L	Max 105°C R.C. ( $A_{rms}$ )		20°C ESR ( $\Omega$ , max.)		Panasonic Part Number
		120Hz	10k~100kHz	120Hz	20kHz				120Hz	10k~100kHz	120Hz	20kHz	
<b>80 VDC Working, 100 VDC Surge</b>							<b>100 VDC Working, 125 VDC Surge</b>						
820	20 x 30	1.20	1.38	0.222	0.145	ECOS1KA821AA	560	20 x 30	1.10	1.65	0.296	0.178	ECOS2AA561AA
1000	20 x 35	1.30	1.50	0.182	0.119	ECOS1KA102AA	820	20 x 35	1.40	2.10	0.202	0.121	ECOS2AA821AA
1200	20 x 40	1.50	1.73	0.166	0.116	ECOS1KA122AA	1000	20 x 40	1.70	2.55	0.182	0.109	ECOS2AA102AA
470	22 x 20	0.80	0.92	0.459	0.298	ECOS1KA471BL	330	22 x 20	0.80	1.20	0.653	0.392	ECOS2AA331BL
470	22 x 25	0.80	0.92	0.388	0.272	ECOS1KA471BA	330	22 x 25	0.80	1.20	0.553	0.332	ECOS2AA331BA
680	22 x 25	1.00	1.15	0.268	0.188	ECOS1KA681BA	470	22 x 25	0.92	1.38	0.388	0.233	ECOS2AA471BA
820	22 x 25	1.20	1.38	0.222	0.145	ECOS1KA821BA	560	22 x 25	1.10	1.65	0.296	0.178	ECOS2AA561BA
1000	22 x 30	1.30	1.50	0.182	0.119	ECOS1KA102BA	820	22 x 30	1.40	2.10	0.202	0.121	ECOS2AA821BA
1200	22 x 30	1.50	1.73	0.166	0.116	ECOS1KA122BA	1000	22 x 35	1.70	2.55	0.182	0.109	ECOS2AA102BA
1500	22 x 35	1.70	1.96	0.133	0.093	ECOS1KA152BA	1200	22 x 40	1.80	2.70	0.152	0.091	ECOS2AA122BA
1800	22 x 40	1.80	2.07	0.111	0.077	ECOS1KA182BA	1500	22 x 45	2.10	3.15	0.122	0.073	ECOS2AA152BA
2200	22 x 45	2.10	2.42	0.090	0.063	ECOS1KA222BA	470	25 x 20	1.00	1.50	0.459	0.275	ECOS2AA471CL
680	25 x 20	1.00	1.15	0.317	0.206	ECOS1KA681CL	820	25 x 25	1.40	2.10	0.202	0.121	ECOS2AA821CA
1000	25 x 25	1.30	1.50	0.182	0.119	ECOS1KA102CA	1000	25 x 30	1.70	2.55	0.182	0.109	ECOS2AA102CA
1200	25 x 25	1.50	1.73	0.166	0.116	ECOS1KA122CA	1200	25 x 35	1.80	2.70	0.152	0.091	ECOS2AA122CA
1500	25 x 30	1.70	1.96	0.133	0.093	ECOS1KA152CA	1500	25 x 40	2.10	3.15	0.122	0.079	ECOS2AA152CA
1800	25 x 35	1.80	2.07	0.111	0.077	ECOS1KA182CA	1800	25 x 45	2.30	3.45	0.111	0.072	ECOS2AA182CA
2200	25 x 35	2.10	2.42	0.090	0.063	ECOS1KA222CA	2200	25 x 50	2.60	3.90	0.090	0.059	ECOS2AA222CA
2700	25 x 45	2.40	2.76	0.074	0.055	ECOS1KA272CA	680	30 x 20	1.10	1.65	0.317	0.190	ECOS2AA681DL
3300	25 x 50	2.60	2.99	0.065	0.049	ECOS1KA332CA	1200	30 x 25	1.80	2.70	0.152	0.091	ECOS2AA122DA
1000	30 x 20	1.20	1.38	0.216	0.140	ECOS1KA102DL	1500	30 x 30	2.10	3.15	0.122	0.079	ECOS2AA152DA
1800	30 x 25	1.80	2.07	0.111	0.077	ECOS1KA182DA	1800	30 x 35	2.30	3.45	0.111	0.072	ECOS2AA182DA
2200	30 x 30	2.10	2.42	0.090	0.063	ECOS1KA222DA	2200	30 x 40	2.60	3.90	0.090	0.059	ECOS2AA222DA
2700	30 x 35	2.40	2.76	0.074	0.055	ECOS1KA272DA	2700	30 x 45	2.90	4.35	0.080	0.052	ECOS2AA272DA
3300	30 x 40	2.60	2.99	0.065	0.049	ECOS1KA332DA	3300	30 x 50	3.20	4.80	0.075	0.053	ECOS2AA332DA
3900	30 x 45	3.00	3.45	0.060	0.045	ECOS1KA392DA	1000	35 x 20	1.20	1.80	0.216	0.129	ECOS2AA102EL
4700	30 x 50	3.30	3.80	0.049	0.037	ECOS1KA472DA	1500	35 x 25	2.10	3.15	0.122	0.079	ECOS2AA152EA
1500	35 x 20	1.40	1.61	0.155	0.108	ECOS1KA152EL	1800	35 x 30	2.30	3.45	0.111	0.072	ECOS2AA182EA
2200	35 x 25	2.10	2.42	0.090	0.063	ECOS1KA222EA	2200	35 x 30	2.60	3.90	0.090	0.059	ECOS2AA222EA
2700	35 x 30	2.40	2.76	0.074	0.055	ECOS1KA272EA	2700	35 x 35	2.90	4.35	0.080	0.052	ECOS2AA272EA
3300	35 x 30	2.60	2.99	0.065	0.049	ECOS1KA332EA	3300	35 x 40	3.20	4.80	0.075	0.053	ECOS2AA332EA
3900	35 x 35	3.00	3.45	0.060	0.045	ECOS1KA392EA	3900	35 x 45	3.60	5.40	0.064	0.045	ECOS2AA392EA
4700	35 x 40	3.30	3.80	0.049	0.037	ECOS1KA472EA	4700	35 x 50	3.80	5.70	0.053	0.040	ECOS2AA472EA
5600	35 x 45	3.70	4.26	0.050	0.038	ECOS1KA562EA	4700	40 x 40	3.80	5.70	0.053	0.040	ECOS2AA472FA
6800	35 x 50	3.90	4.49	0.041	0.031	ECOS1KA682EA	6800	40 x 50	4.57	6.86	0.037	0.027	ECOS2AA682FA
6800	40 x 40	3.90	4.49	0.041	0.031	ECOS1KA682FA							
8200	40 x 50	4.29	4.93	0.036	0.027	ECOS1KA822FA							
<b>160 VDC Working, 200 VDC Surge</b>							<b>200 VDC Working, 250 VDC Surge</b>						
220	20 x 25	1.00	1.40	0.829	0.373	ECOS2CA221AA	220	20 x 30	1.00	1.40	0.754	0.339	ECOS2DA221AA
270	20 x 30	1.10	1.54	0.675	0.304	ECOS2CA271AA	270	20 x 35	1.10	1.54	0.614	0.276	ECOS2DA271AA
330	20 x 35	1.20	1.68	0.653	0.294	ECOS2CA331AA	330	20 x 40	1.20	1.68	0.502	0.226	ECOS2DA331AA
390	20 x 40	1.30	1.82	0.468	0.210	ECOS2CA391AA	100	22 x 20	0.50	0.70	1.989	0.895	ECOS2DA101BL
150	22 x 20	0.55	0.77	1.437	0.647	ECOS2CA151BL	100	22 x 25	0.50	0.70	1.658	0.746	ECOS2DA101BA
150	22 x 25	0.61	0.85	1.216	0.547	ECOS2CA151BA	150	22 x 25	0.68	0.95	1.105	0.497	ECOS2DA151BA
220	22 x 25	0.90	1.26	0.829	0.373	ECOS2CA221BA	220	22 x 25	1.00	1.40	0.754	0.339	ECOS2DA221BA
270	22 x 25	1.10	1.54	0.675	0.304	ECOS2CA271BA	270	22 x 30	1.10	1.54	0.614	0.276	ECOS2DA271BA
330	22 x 30	1.20	1.68	0.553	0.249	ECOS2CA331BA	330	22 x 30	1.20	1.68	0.502	0.226	ECOS2DA331BA
390	22 x 30	1.30	1.82	0.553	0.249	ECOS2CA391BA	390	22 x 35	1.30	1.82	0.425	0.191	ECOS2DA391BA
470	22 x 35	1.40	1.96	0.529	0.238	ECOS2CA471BA	470	22 x 40	1.40	1.96	0.353	0.159	ECOS2DA471BA
560	22 x 40	1.50	2.10	0.385	0.173	ECOS2CA561BA	560	22 x 45	1.50	2.10	0.296	0.133	ECOS2DA561BA
680	22 x 45	1.70	2.38	0.317	0.143	ECOS2CA681BA	150	25 x 20	0.65	0.91	1.326	0.597	ECOS2DA151CL
220	25 x 20	0.75	1.05	0.980	0.441	ECOS2CA221CL	270	25 x 25	1.10	1.54	0.614	0.276	ECOS2DA271CA
390	25 x 25	1.30	1.82	0.553	0.249	ECOS2CA391CA	330	25 x 25	1.20	1.68	0.502	0.226	ECOS2DA331CA
470	25 x 30	1.40	1.96	0.459	0.206	ECOS2CA471CA	390	25 x 30	1.30	1.82	0.425	0.191	ECOS2DA391CA
560	25 x 30	1.50	2.10	0.385	0.173	ECOS2CA561CA	470	25 x 35	1.40	1.96	0.353	0.159	ECOS2DA471CA
680	25 x 35	1.70	2.38	0.317	0.143	ECOS2CA681CA	560	25 x 35	1.50	2.10	0.296	0.133	ECOS2DA561CA
820	25 x 40	2.00	2.80	0.263	0.118	ECOS2CA821CA	680	25 x 40	1.70	2.38	0.244	0.110	ECOS2DA681CA
1000	25 x 45	2.20	3.08	0.216	0.108	ECOS2CA102CA	820	25 x 50	2.00	2.80	0.222	0.111	ECOS2DA821CA
1200	25 x 50	2.30	3.22	0.180	0.090	ECOS2CA122CA	220	30 x 20	0.87	1.22	0.904	0.407	ECOS2DA221DL
330	30 x 20	1.00	1.40	0.553	0.249	ECOS2CA331DL	390	30 x 25	1.30	1.82	0.425	0.191	ECOS2DA391DA
560	30 x 25	1.50	2.10	0.385	0.173	ECOS2CA561DA	470	30 x 25	1.40	1.96	0.353	0.159	ECOS2DA471DA
680	30 x 30	1.70	2.38	0.317	0.143	ECOS2CA681DA	560	30 x 30	1.50	2.10	0.296	0.133	ECOS2DA561DA
820	30 x 30	2.00	2.80	0.263	0.118	ECOS2CA821DA	680	30 x 30	1.70	2.38	0.244	0.110	ECOS2DA681DA
1000	30 x 35	2.20	3.08	0.216	0.108	ECOS2CA102DA	820	30 x 35	2.00	2.80	0.222	0.111	ECOS2DA821DA
1200	30 x 40	2.30	3.22	0.180	0.090	ECOS2CA122DA	1000	30 x 45	2.20	3.08	0.199	0.099	ECOS2DA102DA
1500	30 x 45	2.50	3.50	0.166	0.083	ECOS2CA152DA	1200	30 x 50	2.30	3.22	0.166	0.083	ECOS2DA122DA
1800	30 x 50	2.70	3.78	0.138	0.083	ECOS2CA182DA	330	35 x 20	1.10	1.54	0.603	0.271	ECOS2DA331EL
470	35 x 20	1.15	1.61	0.459	0.206	ECOS2CA471EL	820	35 x 30	2.00	2.80	0.222	0.111	ECOS2DA821EA
1500	35 x 35	2.50	3.50	0.166	0.083	ECOS2CA152EA	1000	35 x 35	2.20	3.08	0.199	0.099	ECOS2DA102EA
1800	35 x 40	2.70	3.78	0.138	0.069	ECOS2CA182EA	1200	35 x 40	2.30	3.22	0.166	0.083	ECOS2DA122EA
2200	35 x 50	2.90	4.06	0.113	0.057	ECOS2CA222EA	1500	35 x 50	2.50	3.50	0.144	0.072	ECOS2DA152EA

### 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	Cap. ( $\mu$ F)	Size (mm) D x L	Max 105°C R.C. ( $A_{rms}$ )		20°C ESR ( $\Omega$ , max.)		Panasonic Part Number
		120Hz	10k~100kHz	120Hz	20kHz				120Hz	10k~100kHz	120Hz	20kHz	
<b>250 VDC Working, 300 VDC Surge</b>							<b>385 VDC Working, 435 VDC Surge</b>						
180	20 x 35	0.90	1.26	0.921	0.461	ECOS2EA181AA	56	20 x 30	0.51	0.71	2.368	0.829	ECOS2TA560AA
220	20 x 40	1.00	1.40	0.754	0.377	ECOS2EA221AA	68	20 x 35	0.56	0.78	1.950	0.683	ECOS2TA680AA
68	22 x 20	0.40	0.56	2.926	1.463	ECOS2EA680BL	82	20 x 40	0.64	0.90	1.617	0.566	ECOS2TA820AA
68	22 x 25	0.40	0.56	2.438	1.219	ECOS2EA680BA	33	22 x 20	0.20	0.28	5.024	1.758	ECOS2TA330BL
100	22 x 25	0.55	0.77	1.658	0.829	ECOS2EA101BA	56	22 x 25	0.51	0.71	2.368	0.829	ECOS2TA560BA
150	22 x 25	0.75	1.05	1.105	0.553	ECOS2EA151BA	68	22 x 30	0.56	0.78	1.950	0.683	ECOS2TA680BA
180	22 x 30	0.90	1.26	0.921	0.461	ECOS2EA181BA	82	22 x 35	0.64	0.90	1.617	0.566	ECOS2TA820BA
220	22 x 30	1.00	1.40	0.754	0.377	ECOS2EA221BA	100	22 x 35	0.69	0.97	1.326	0.464	ECOS2TA101BA
270	22 x 35	1.10	1.54	0.614	0.307	ECOS2EA271BA	120	22 x 35	0.75	1.05	1.105	0.387	ECOS2TA121BA
330	22 x 40	1.20	1.68	0.502	0.251	ECOS2EA331BA	150	22 x 50	0.82	1.15	0.884	0.309	ECOS2TA151BA
390	22 x 45	1.30	1.82	0.425	0.213	ECOS2EA391BA	47	25 x 20	0.25	0.35	3.527	1.235	ECOS2TA470CL
100	25 x 20	0.50	0.70	1.989	0.995	ECOS2EA101CL	68	25 x 25	0.56	0.78	1.950	0.683	ECOS2TA680CA
180	25 x 25	0.90	1.26	0.921	0.461	ECOS2EA181CA	82	25 x 25	0.64	0.90	1.617	0.566	ECOS2TA820CA
220	25 x 25	1.00	1.40	0.754	0.377	ECOS2EA221CA	100	25 x 30	0.69	0.97	1.326	0.464	ECOS2TA101CA
270	25 x 30	1.10	1.54	0.614	0.307	ECOS2EA271CA	120	25 x 30	0.75	1.05	1.105	0.387	ECOS2TA121CA
330	25 x 35	1.20	1.68	0.502	0.251	ECOS2EA331CA	150	25 x 40	0.82	1.15	0.884	0.309	ECOS2TA151CA
390	25 x 35	1.30	1.82	0.425	0.213	ECOS2EA391CA	180	25 x 45	0.95	1.33	0.737	0.258	ECOS2TA181CA
470	25 x 45	1.40	1.96	0.353	0.176	ECOS2EA471CA	220	25 x 50	1.10	1.54	0.603	0.211	ECOS2TA221CA
560	25 x 50	1.50	2.10	0.296	0.148	ECOS2EA561CA	68	30 x 20	0.35	0.49	2.438	0.853	ECOS2TA680DL
150	30 x 20	0.65	0.91	1.326	0.663	ECOS2EA151DL	150	30 x 30	0.82	1.15	0.884	0.309	ECOS2TA151DA
270	30 x 25	1.10	1.54	0.614	0.307	ECOS2EA271DA	180	30 x 35	0.95	1.33	0.737	0.258	ECOS2TA181DA
330	30 x 25	1.20	1.68	0.502	0.251	ECOS2EA331DA	220	30 x 40	1.10	1.54	0.603	0.211	ECOS2TA221DA
390	30 x 30	1.30	1.82	0.425	0.213	ECOS2EA391DA	270	30 x 45	1.20	1.68	0.491	0.172	ECOS2TA271DA
470	30 x 35	1.40	1.96	0.353	0.176	ECOS2EA471DA	330	30 x 50	1.35	1.89	0.402	0.161	ECOS2TA331DA
560	30 x 35	1.50	2.10	0.296	0.148	ECOS2EA561DA	100	35 x 20	0.47	0.66	1.658	0.580	ECOS2TA101EL
680	30 x 45	1.70	2.38	0.244	0.122	ECOS2EA681DA	180	35 x 25	0.95	1.33	0.737	0.258	ECOS2TA181EA
820	30 x 50	2.00	2.80	0.202	0.101	ECOS2EA821DA	220	35 x 30	1.10	1.54	0.603	0.211	ECOS2TA221EA
220	35 x 20	0.87	1.22	0.904	0.452	ECOS2EA221EL	270	35 x 35	1.20	1.68	0.491	0.172	ECOS2TA271EA
470	35 x 30	1.40	1.96	0.353	0.176	ECOS2EA471EA	330	35 x 40	1.35	1.89	0.402	0.161	ECOS2TA331EA
560	35 x 30	1.50	2.10	0.296	0.148	ECOS2EA561EA	390	35 x 45	1.55	2.17	0.340	0.136	ECOS2TA391EA
680	35 x 35	1.70	2.38	0.244	0.122	ECOS2EA681EA	470	35 x 50	1.75	2.45	0.282	0.127	ECOS2TA471EA
820	35 x 40	2.00	2.80	0.202	0.101	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							
<b>400 VDC Working, 450 VDC Surge</b>							<b>450 VDC Working, 500 VDC Surge</b>						
56	20 x 30	0.51	0.71	2.368	0.829	ECOS2GA560AA	56	22 x 25	0.40	0.56	2.368	0.947	ECOS2WA560BA
68	20 x 35	0.56	0.78	1.950	0.683	ECOS2GA680AA	68	22 x 30	0.50	0.70	1.950	0.780	ECOS2WA680BA
82	20 x 40	0.64	0.90	1.617	0.566	ECOS2GA820AA	82	22 x 35	0.56	0.78	1.617	0.647	ECOS2WA820BA
33	22 x 20	0.20	0.28	5.024	1.758	ECOS2GA330BL	100	22 x 40	0.64	0.90	1.326	0.531	ECOS2WA101BA
33	22 x 25	0.30	0.42	4.521	1.582	ECOS2GA330BA	120	22 x 45	0.72	1.01	1.105	0.442	ECOS2WA121BA
47	22 x 25	0.43	0.60	2.822	0.988	ECOS2GA470BA	150	22 x 50	0.79	1.11	0.884	0.354	ECOS2WA151BA
56	22 x 25	0.51	0.71	2.368	0.829	ECOS2GA560BA	68	25 x 25	0.50	0.70	1.950	0.780	ECOS2WA680CA
68	22 x 30	0.56	0.78	1.950	0.683	ECOS2GA680BA	100	25 x 30	0.64	0.90	1.326	0.531	ECOS2WA101CA
82	22 x 35	0.64	0.90	1.617	0.566	ECOS2GA820BA	120	25 x 35	0.72	1.01	1.105	0.442	ECOS2WA121CA
100	22 x 35	0.69	0.97	1.326	0.464	ECOS2GA101BA	150	25 x 40	0.79	1.11	0.884	0.354	ECOS2WA151CA
120	22 x 40	0.75	1.05	1.105	0.387	ECOS2GA121BA	180	25 x 45	0.87	1.22	0.737	0.295	ECOS2WA181CA
150	22 x 50	0.82	1.15	0.884	0.309	ECOS2GA151BA	220	25 x 50	1.00	1.40	0.678	0.271	ECOS2WA221CA
47	25 x 20	0.25	0.35	3.527	1.235	ECOS2GA470CL	100	30 x 25	0.64	0.90	1.326	0.531	ECOS2WA101DA
68	25 x 25	0.56	0.78	1.950	0.683	ECOS2GA680CA	150	30 x 30	0.79	1.11	0.884	0.354	ECOS2WA151DA
82	25 x 25	0.64	0.90	1.617	0.566	ECOS2GA820CA	180	30 x 35	0.87	1.22	0.737	0.295	ECOS2WA181DA
100	25 x 30	0.69	0.97	1.326	0.464	ECOS2GA101CA	220	30 x 40	1.00	1.40	0.678	0.271	ECOS2WA221DA
120	25 x 35	0.75	1.05	1.105	0.387	ECOS2GA121CA	270	30 x 45	1.17	1.64	0.614	0.246	ECOS2WA271DA
150	25 x 40	0.82	1.15	0.884	0.309	ECOS2GA151CA	330	30 x 50	1.38	1.93	0.502	0.201	ECOS2WA331DA
180	25 x 45	0.95	1.33	0.737	0.258	ECOS2GA181CA	150	35 x 25	0.79	1.11	0.884	0.354	ECOS2WA151EA
220	25 x 50	1.10	1.54	0.603	0.211	ECOS2GA221CA	220	35 x 30	1.00	1.40	0.678	0.271	ECOS2WA221EA
68	30 x 20	0.35	0.49	2.438	0.853	ECOS2GA680DL	270	35 x 35	1.17	1.64	0.614	0.246	ECOS2WA271EA
120	30 x 25	0.75	1.05	1.105	0.387	ECOS2GA121DA	330	35 x 40	1.38	1.93	0.502	0.201	ECOS2WA331EA
150	30 x 30	0.82	1.15	0.884	0.309	ECOS2GA151DA	390	35 x 50	1.55	2.17	0.425	0.170	ECOS2WA391EA
180	30 x 35	0.95	1.33	0.737	0.258	ECOS2GA181DA							
220	30 x 40	1.10	1.54	0.603	0.211	ECOS2GA221DA							
270	30 x 45	1.20	1.68	0.491	0.172	ECOS2GA271DA							
330	30 x 50	1.35	1.89	0.402	0.161	ECOS2GA331DA							
100	35 x 20	0.47	0.66	1.658	0.580	ECOS2GA101EL							
180	35 x 25	0.95	1.33	0.737	0.258	ECOS2GA181EA							
220	35 x 30	1.10	1.54	0.603	0.211	ECOS2GA221EA							
270	35 x 35	1.20	1.68	0.491	0.172	ECOS2GA271EA							
330	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							