

## 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:<br>(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)<br>*2000 hours for 20mm diameter or 20mm length sizes |    |    |    |    |                             |    |    |           |  |

### Part Number System

|                               |          |                 |  |        |          |                     |  |                  |  |                   |
|-------------------------------|----------|-----------------|--|--------|----------|---------------------|--|------------------|--|-------------------|
| <b>E</b>                      | <b>C</b> |                 |  |        | <b>A</b> |                     |  |                  |  |                   |
| Common Code/<br>Terminal Type |          | Voltage<br>Code |  | Series |          | Capacitance<br>Code |  | Case<br>Diameter |  | Top Vinyl Plate   |
|                               |          |                 |  |        |          |                     |  |                  |  | 25 ~ 50mm lengths |
|                               |          |                 |  |        |          |                     |  |                  |  | A With Plate      |
|                               |          |                 |  |        |          |                     |  |                  |  | B Without plate   |
|                               |          |                 |  |        |          |                     |  |                  |  | 20mm length       |
|                               |          |                 |  |        |          |                     |  |                  |  | L With Plate      |
|                               |          |                 |  |        |          |                     |  |                  |  | G Without plate   |

|              |                                  |
|--------------|----------------------------------|
| <b>ECOS</b>  | 6.3mm Length Terminal (Standard) |
| <b>ECEC</b>  | 4mm Length "Short" Terminal      |
| (See page 7) |                                  |

|          |      |
|----------|------|
| <b>A</b> | 20mm |
| <b>B</b> | 22mm |
| <b>C</b> | 25mm |
| <b>D</b> | 30mm |
| <b>E</b> | 35mm |
| <b>F</b> | 40mm |

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

| Standard Ratings             |                    |                                    |            |                    |       |                          |
|------------------------------|--------------------|------------------------------------|------------|--------------------|-------|--------------------------|
| Cap.<br>(μF)                 | Size (mm)<br>D x L | Max 105°C R.C. (A <sub>rms</sub> ) |            | 20°C ESR (Ω, max.) |       | Panasonic<br>Part Number |
|                              |                    | 120Hz                              | 10k~100kHz | 120Hz              | 20kHz |                          |
| 10 VDC Working, 13 VDC Surge |                    |                                    |            |                    |       |                          |
| 6800                         | 20 x 25            | 1.30                               | 1.50       | 0.110              | 0.093 | ECOS1AA682AA             |
| 8200                         | 20 x 30            | 1.60                               | 1.84       | 0.091              | 0.077 | ECOS1AA822AA             |
| 10000                        | 20 x 30            | 1.80                               | 2.07       | 0.075              | 0.063 | ECOS1AA103AA             |
| 12000                        | 20 x 35            | 2.20                               | 2.53       | 0.062              | 0.053 | ECOS1AA123AA             |
| 15000                        | 20 x 40            | 2.30                               | 2.65       | 0.053              | 0.045 | ECOS1AA153AA             |
| 4700                         | 22 x 25            | 0.85                               | 0.98       | 0.159              | 0.135 | ECOS1AA472BA             |
| 6800                         | 22 x 25            | 1.30                               | 1.50       | 0.110              | 0.093 | ECOS1AA682BA             |
| 10000                        | 22 x 25            | 1.80                               | 2.07       | 0.075              | 0.063 | ECOS1AA103BA             |
| 12000                        | 22 x 30            | 2.20                               | 2.53       | 0.062              | 0.053 | ECOS1AA123BA             |
| 15000                        | 22 x 35            | 2.30                               | 2.65       | 0.053              | 0.045 | ECOS1AA153BA             |
| 18000                        | 22 x 40            | 2.40                               | 2.76       | 0.044              | 0.038 | ECOS1AA183BA             |
| 22000                        | 22 x 45            | 2.60                               | 2.99       | 0.038              | 0.032 | ECOS1AA223BA             |
| 27000                        | 22 x 50            | 3.10                               | 3.57       | 0.033              | 0.028 | ECOS1AA273BA             |
| 15000                        | 25 x 25            | 2.30                               | 2.65       | 0.053              | 0.045 | ECOS1AA153CA             |
| 18000                        | 25 x 30            | 2.40                               | 2.76       | 0.044              | 0.038 | ECOS1AA183CA             |
| 22000                        | 25 x 35            | 2.60                               | 2.99       | 0.038              | 0.032 | ECOS1AA223CA             |
| 27000                        | 25 x 40            | 3.10                               | 3.57       | 0.033              | 0.028 | ECOS1AA273CA             |
| 33000                        | 25 x 45            | 3.40                               | 3.91       | 0.027              | 0.023 | ECOS1AA333CA             |
| 39000                        | 25 x 50            | 3.70                               | 4.26       | 0.025              | 0.021 | ECOS1AA393CA             |
| 22000                        | 30 x 25            | 2.60                               | 2.99       | 0.038              | 0.032 | ECOS1AA223DA             |
| 27000                        | 30 x 30            | 3.10                               | 3.57       | 0.033              | 0.028 | ECOS1AA273DA             |
| 33000                        | 30 x 35            | 3.40                               | 3.91       | 0.027              | 0.023 | ECOS1AA333DA             |
| 39000                        | 30 x 40            | 3.70                               | 4.26       | 0.025              | 0.021 | ECOS1AA393DA             |
| 47000                        | 30 x 45            | 4.20                               | 4.83       | 0.023              | 0.020 | ECOS1AA473DA             |
| 56000                        | 30 x 50            | 5.00                               | 5.75       | 0.022              | 0.019 | ECOS1AA563DA             |
| 27000                        | 35 x 25            | 3.10                               | 3.57       | 0.033              | 0.028 | ECOS1AA273EA             |
| 33000                        | 35 x 30            | 3.40                               | 3.91       | 0.027              | 0.023 | ECOS1AA333EA             |
| 39000                        | 35 x 30            | 3.70                               | 4.26       | 0.025              | 0.021 | ECOS1AA393EA             |
| 47000                        | 35 x 35            | 4.20                               | 4.83       | 0.023              | 0.020 | ECOS1AA473EA             |
| 56000                        | 35 x 40            | 5.00                               | 5.75       | 0.022              | 0.021 | ECOS1AA563EA             |
| 68000                        | 35 x 50            | 5.50                               | 6.33       | 0.021              | 0.020 | ECOS1AA683EA             |
| 62000                        | 40 x 40            | 5.42                               | 6.23       | 0.023              | 0.022 | ECOS1AA623FA             |
| 82000                        | 40 x 50            | 7.36                               | 8.46       | 0.018              | 0.017 | ECOS1AA823FA             |

| Standard Ratings             |                    |                                    |            |                    |       |                          |
|------------------------------|--------------------|------------------------------------|------------|--------------------|-------|--------------------------|
| Cap.<br>(μF)                 | Size (mm)<br>D x L | Max 105°C R.C. (A <sub>rms</sub> ) |            | 20°C ESR (Ω, max.) |       | Panasonic<br>Part Number |
|                              |                    | 120Hz                              | 10k~100kHz | 120Hz              | 20kHz |                          |
| 16 VDC Working, 20 VDC Surge |                    |                                    |            |                    |       |                          |
| 6800                         | 20 x 30            | 2.20                               | 2.53       | 0.085              | 0.068 | ECOS1CA682AA             |
| 8200                         | 20 x 35            | 2.40                               | 2.76       | 0.071              | 0.057 | ECOS1CA822AA             |
| 10000                        | 20 x 40            | 2.60                               | 2.99       | 0.066              | 0.053 | ECOS1CA103AA             |
| 3300                         | 22 x 20            | 1.30                               | 1.50       | 0.216              | 0.173 | ECOS1CA332BL             |
| 3300                         | 22 x 25            | 1.30                               | 1.50       | 0.176              | 0.141 | ECOS1CA332BA             |
| 4700                         | 22 x 25            | 1.52                               | 1.75       | 0.123              | 0.099 | ECOS1CA472BA             |
| 6800                         | 22 x 25            | 2.20                               | 2.53       | 0.085              | 0.068 | ECOS1CA682BA             |
| 8200                         | 22 x 30            | 2.40                               | 2.76       | 0.071              | 0.057 | ECOS1CA822BA             |
| 10000                        | 22 x 30            | 2.60                               | 2.99       | 0.066              | 0.053 | ECOS1CA103BA             |
| 12000                        | 22 x 35            | 2.90                               | 3.34       | 0.055              | 0.044 | ECOS1CA123BA             |
| 15000                        | 22 x 40            | 3.20                               | 3.68       | 0.046              | 0.037 | ECOS1CA153BA             |
| 18000                        | 22 x 45            | 3.50                               | 4.03       | 0.040              | 0.034 | ECOS1CA183BA             |
| 4700                         | 25 x 20            | 1.60                               | 1.84       | 0.152              | 0.121 | ECOS1CA472CL             |
| 10000                        | 25 x 25            | 2.60                               | 2.99       | 0.066              | 0.053 | ECOS1CA103CA             |
| 12000                        | 25 x 30            | 2.90                               | 3.34       | 0.055              | 0.044 | ECOS1CA123CA             |
| 15000                        | 25 x 35            | 3.20                               | 3.68       | 0.046              | 0.037 | ECOS1CA153CA             |
| 18000                        | 25 x 40            | 3.50                               | 4.03       | 0.040              | 0.034 | ECOS1CA183CA             |
| 22000                        | 25 x 45            | 3.80                               | 4.37       | 0.033              | 0.028 | ECOS1CA223CA             |
| 27000                        | 25 x 50            | 4.20                               | 4.83       | 0.028              | 0.025 | ECOS1CA273CA             |
| 6800                         | 30 x 20            | 1.80                               | 2.07       | 0.105              | 0.084 | ECOS1CA682DL             |
| 12000                        | 30 x 25            | 2.90                               | 3.34       | 0.055              | 0.044 | ECOS1CA123DA             |
| 15000                        | 30 x 30            | 3.20                               | 3.68       | 0.046              | 0.037 | ECOS1CA153DA             |
| 18000                        | 30 x 30            | 3.50                               | 4.03       | 0.040              | 0.034 | ECOS1CA183DA             |
| 22000                        | 30 x 35            | 3.80                               | 4.37       | 0.033              | 0.028 | ECOS1CA223DA             |
| 27000                        | 30 x 40            | 4.20                               | 4.83       | 0.028              | 0.025 | ECOS1CA273DA             |
| 33000                        | 30 x 45            | 4.70                               | 5.41       | 0.023              | 0.020 | ECOS1CA333DA             |
| 39000                        | 30 x 50            | 5.10                               | 5.87       | 0.022              | 0.020 | ECOS1CA393DA             |
| 10000                        | 35 x 20            | 2.40                               | 2.76       | 0.071              | 0.057 | ECOS1CA103EL             |
| 18000                        | 35 x 25            | 3.50                               | 4.03       | 0.040              | 0.034 | ECOS1CA183EA             |
| 22000                        | 35 x 30            | 3.80                               | 4.37       | 0.033              | 0.028 | ECOS1CA223EA             |
| 27000                        | 35 x 30            | 4.20                               | 4.83       | 0.028              | 0.025 | ECOS1CA273EA             |
| 33000                        | 35 x 35            | 4.70                               | 5.41       | 0.023              | 0.020 | ECOS1CA333EA             |
| 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.<br>( $\mu$ F)           | Size (mm)<br>D x L | Max 105°C R.C. ( $A_{rms}$ ) |            | 20°C ESR ( $\Omega$ , max.) |       | Panasonic    |
|------------------------------|--------------------|------------------------------|------------|-----------------------------|-------|--------------|
|                              |                    | 120Hz                        | 10k~100kHz | 120Hz                       | 20kHz | Part Number  |
| 25 VDC Working, 32 VDC Surge |                    |                              |            |                             |       |              |
| 4700                         | 20 x 30            | 2.00                         | 2.30       | 0.106                       | 0.079 | ECOS1EA472AA |
| 5600                         | 20 x 35            | 2.20                         | 2.53       | 0.089                       | 0.067 | ECOS1EA562AA |
| 6800                         | 20 x 40            | 2.40                         | 2.76       | 0.073                       | 0.055 | ECOS1EA682AA |
| 2200                         | 22 x 20            | 1.30                         | 1.50       | 0.241                       | 0.181 | ECOS1EA222BL |
| 2200                         | 22 x 25            | 1.30                         | 1.50       | 0.241                       | 0.181 | ECOS1EA222BA |
| 3300                         | 22 x 25            | 1.62                         | 1.86       | 0.161                       | 0.121 | ECOS1EA332BA |
| 4700                         | 22 x 25            | 2.00                         | 2.30       | 0.106                       | 0.079 | ECOS1EA472BA |
| 5600                         | 22 x 30            | 2.20                         | 2.53       | 0.089                       | 0.067 | ECOS1EA562BA |
| 6800                         | 22 x 30            | 2.40                         | 2.76       | 0.073                       | 0.055 | ECOS1EA682BA |
| 8200                         | 22 x 35            | 2.70                         | 3.11       | 0.061                       | 0.045 | ECOS1EA822BA |
| 10000                        | 22 x 40            | 3.00                         | 3.45       | 0.051                       | 0.039 | ECOS1EA103BA |
| 12000                        | 22 x 45            | 3.20                         | 3.68       | 0.044                       | 0.033 | ECOS1EA123BA |
| 3300                         | 25 x 20            | 1.60                         | 1.84       | 0.161                       | 0.121 | ECOS1EA332CL |
| 6800                         | 25 x 25            | 2.40                         | 2.76       | 0.073                       | 0.055 | ECOS1EA682CA |
| 8200                         | 25 x 30            | 2.70                         | 3.11       | 0.061                       | 0.045 | ECOS1EA822CA |
| 10000                        | 25 x 35            | 3.00                         | 3.45       | 0.051                       | 0.039 | ECOS1EA103CA |
| 12000                        | 25 x 40            | 3.20                         | 3.68       | 0.044                       | 0.035 | ECOS1EA123CA |
| 15000                        | 25 x 45            | 3.60                         | 4.14       | 0.036                       | 0.031 | ECOS1EA153CA |
| 18000                        | 25 x 50            | 3.90                         | 4.49       | 0.030                       | 0.027 | ECOS1EA183CA |
| 4700                         | 30 x 20            | 1.80                         | 2.07       | 0.113                       | 0.085 | ECOS1EA472DL |
| 8200                         | 30 x 25            | 2.70                         | 3.11       | 0.061                       | 0.045 | ECOS1EA822DA |
| 10000                        | 30 x 30            | 3.00                         | 3.45       | 0.051                       | 0.039 | ECOS1EA103DA |
| 12000                        | 30 x 30            | 3.20                         | 3.68       | 0.044                       | 0.035 | ECOS1EA123DA |
| 15000                        | 30 x 35            | 3.60                         | 4.14       | 0.036                       | 0.031 | ECOS1EA153DA |
| 18000                        | 30 x 40            | 3.90                         | 4.49       | 0.030                       | 0.027 | ECOS1EA183DA |
| 22000                        | 30 x 45            | 4.30                         | 4.95       | 0.025                       | 0.022 | ECOS1EA223DA |
| 6800                         | 35 x 20            | 2.30                         | 2.65       | 0.080                       | 0.060 | ECOS1EA682EL |
| 12000                        | 35 x 25            | 3.20                         | 3.68       | 0.044                       | 0.035 | ECOS1EA123EA |
| 15000                        | 35 x 30            | 3.60                         | 4.14       | 0.036                       | 0.031 | ECOS1EA153EA |
| 18000                        | 35 x 35            | 3.90                         | 4.49       | 0.030                       | 0.027 | ECOS1EA183EA |
| 22000                        | 35 x 35            | 4.30                         | 4.95       | 0.025                       | 0.022 | ECOS1EA223EA |
| 27000                        | 35 x 45            | 4.80                         | 5.52       | 0.021                       | 0.019 | ECOS1EA273EA |
| 33000                        | 35 x 50            | 5.50                         | 6.33       | 0.018                       | 0.016 | ECOS1EA333EA |
| 33000                        | 40 x 40            | 5.50                         | 6.33       | 0.018                       | 0.016 | ECOS1EA333FA |
| 47000                        | 40 x 50            | 6.47                         | 7.44       | 0.015                       | 0.014 | ECOS1EA473FA |
| 50 VDC Working, 63 VDC Surge |                    |                              |            |                             |       |              |
| 1800                         | 20 x 30            | 1.50                         | 1.73       | 0.129                       | 0.097 | ECOS1HA182AA |
| 2200                         | 20 x 35            | 1.70                         | 1.96       | 0.105                       | 0.079 | ECOS1HA222AA |
| 2700                         | 20 x 40            | 1.80                         | 2.07       | 0.086                       | 0.064 | ECOS1HA272AA |
| 1000                         | 22 x 20            | 0.90                         | 1.04       | 0.265                       | 0.199 | ECOS1HA102BL |
| 1000                         | 22 x 25            | 0.90                         | 1.04       | 0.232                       | 0.174 | ECOS1HA102BA |
| 1500                         | 22 x 25            | 1.25                         | 1.44       | 0.155                       | 0.116 | ECOS1HA152BA |
| 1800                         | 22 x 25            | 1.50                         | 1.73       | 0.129                       | 0.097 | ECOS1HA182BA |
| 2200                         | 22 x 30            | 1.70                         | 1.96       | 0.105                       | 0.079 | ECOS1HA222BA |
| 2700                         | 22 x 30            | 1.80                         | 2.07       | 0.086                       | 0.064 | ECOS1HA272BA |
| 3300                         | 22 x 35            | 2.00                         | 2.30       | 0.070                       | 0.053 | ECOS1HA332BA |
| 3900                         | 22 x 40            | 2.20                         | 2.53       | 0.064                       | 0.048 | ECOS1HA392BA |
| 4700                         | 22 x 45            | 2.50                         | 2.88       | 0.053                       | 0.040 | ECOS1HA472BA |
| 5600                         | 22 x 50            | 2.80                         | 3.22       | 0.050                       | 0.038 | ECOS1HA562BA |
| 1500                         | 25 x 20            | 1.20                         | 1.38       | 0.177                       | 0.133 | ECOS1HA152CL |
| 2700                         | 25 x 25            | 1.80                         | 2.07       | 0.086                       | 0.064 | ECOS1HA272CA |
| 3300                         | 25 x 30            | 2.00                         | 2.30       | 0.070                       | 0.053 | ECOS1HA332CA |
| 3900                         | 25 x 35            | 2.20                         | 2.53       | 0.064                       | 0.048 | ECOS1HA392CA |
| 4700                         | 25 x 40            | 2.50                         | 2.88       | 0.053                       | 0.040 | ECOS1HA472CA |
| 5600                         | 25 x 40            | 2.80                         | 3.22       | 0.050                       | 0.038 | ECOS1HA562CA |
| 6800                         | 25 x 50            | 3.30                         | 3.80       | 0.046                       | 0.035 | ECOS1HA682CA |
| 2200                         | 30 x 20            | 1.40                         | 1.61       | 0.121                       | 0.090 | ECOS1HA222DL |
| 3900                         | 30 x 25            | 2.20                         | 2.53       | 0.064                       | 0.048 | ECOS1HA392DA |
| 4700                         | 30 x 30            | 2.50                         | 2.88       | 0.053                       | 0.040 | ECOS1HA472DA |
| 5600                         | 30 x 35            | 2.80                         | 3.22       | 0.050                       | 0.038 | ECOS1HA562DA |
| 6800                         | 30 x 40            | 3.30                         | 3.80       | 0.046                       | 0.035 | ECOS1HA682DA |
| 8200                         | 30 x 45            | 3.60                         | 4.14       | 0.038                       | 0.029 | ECOS1HA822DA |
| 10000                        | 30 x 50            | 4.00                         | 4.60       | 0.033                       | 0.025 | ECOS1HA103DA |
| 3300                         | 35 x 20            | 1.70                         | 1.96       | 0.085                       | 0.064 | ECOS1HA332EL |
| 4700                         | 35 x 25            | 2.50                         | 2.88       | 0.053                       | 0.040 | ECOS1HA472EA |
| 5600                         | 35 x 30            | 2.80                         | 3.22       | 0.050                       | 0.038 | ECOS1HA562EA |
| 6800                         | 35 x 30            | 3.30                         | 3.80       | 0.046                       | 0.035 | ECOS1HA682EA |
| 8200                         | 35 x 35            | 3.60                         | 4.14       | 0.038                       | 0.029 | ECOS1HA822EA |
| 10000                        | 35 x 40            | 4.00                         | 4.60       | 0.033                       | 0.025 | ECOS1HA103EA |
| 12000                        | 35 x 45            | 4.50                         | 5.18       | 0.028                       | 0.022 | ECOS1HA123EA |
| 15000                        | 35 x 50            | 4.80                         | 5.52       | 0.022                       | 0.018 | ECOS1HA153EA |
| 15000                        | 40 x 40            | 4.80                         | 5.52       | 0.022                       | 0.018 | ECOS1HA153FA |
| 22000                        | 40 x 50            | 5.15                         | 5.92       | 0.016                       | 0.013 | ECOS1HA223FA |

| Cap.<br>( $\mu$ F)           | Size (mm)<br>D x L | Max 105°C R.C. ( $A_{rms}$ ) |            | 20°C ESR ( $\Omega$ , max.) |       | Panasonic    |
|------------------------------|--------------------|------------------------------|------------|-----------------------------|-------|--------------|
|                              |                    | 120Hz                        | 10k~100kHz | 120Hz                       | 20kHz | Part Number  |
| 35 VDC Working, 44 VDC Surge |                    |                              |            |                             |       |              |
| 3300                         | 20 x 30            | 1.90                         | 2.19       | 0.121                       | 0.090 | ECOS1VA332AA |
| 3900                         | 20 x 35            | 2.00                         | 2.30       | 0.111                       | 0.083 | ECOS1VA392AA |
| 4700                         | 20 x 40            | 2.20                         | 2.53       | 0.088                       | 0.066 | ECOS1VA472AA |
| 1500                         | 22 x 20            | 1.10                         | 1.27       | 0.287                       | 0.216 | ECOS1VA152BL |
| 1500                         | 22 x 25            | 1.10                         | 1.27       | 0.287                       | 0.216 | ECOS1VA152BA |
| 2200                         | 22 x 25            | 1.48                         | 1.70       | 0.196                       | 0.147 | ECOS1VA222BA |
| 3300                         | 22 x 25            | 1.90                         | 2.19       | 0.121                       | 0.090 | ECOS1VA332BA |
| 3900                         | 22 x 30            | 2.00                         | 2.30       | 0.111                       | 0.083 | ECOS1VA392BA |
| 4700                         | 22 x 35            | 2.20                         | 2.53       | 0.088                       | 0.066 | ECOS1VA472BA |
| 5600                         | 22 x 35            | 2.40                         | 2.76       | 0.074                       | 0.056 | ECOS1VA562BA |
| 6800                         | 22 x 40            | 2.60                         | 2.99       | 0.061                       | 0.046 | ECOS1VA682BA |
| 8200                         | 22 x 50            | 2.90                         | 3.34       | 0.051                       | 0.038 | ECOS1VA822BA |
| 2200                         | 25 x 20            | 1.40                         | 1.61       | 0.196                       | 0.147 | ECOS1VA222CL |
| 4700                         | 25 x 25            | 2.20                         | 2.53       | 0.088                       | 0.066 | ECOS1VA472CA |
| 5600                         | 25 x 30            | 2.40                         | 2.76       | 0.074                       | 0.056 | ECOS1VA562CA |
| 6800                         | 25 x 35            | 2.60                         | 2.99       | 0.061                       | 0.046 | ECOS1VA682CA |
| 8200                         | 25 x 40            | 2.90                         | 3.34       | 0.051                       | 0.038 | ECOS1VA822CA |
| 10000                        | 25 x 45            | 3.20                         | 3.68       | 0.041                       | 0.031 | ECOS1VA103CA |
| 12000                        | 25 x 50            | 3.50                         | 4.03       | 0.035                       | 0.026 | ECOS1VA123CA |
| 3300                         | 30 x 20            | 1.70                         | 1.96       | 0.131                       | 0.098 | ECOS1VA332DL |
| 5600                         | 30 x 25            | 2.40                         | 2.76       | 0.074                       | 0.056 | ECOS1VA562DA |
| 6800                         | 30 x 30            | 2.60                         | 2.99       | 0.061                       | 0.046 | ECOS1VA682DA |
| 8200                         | 30 x 30            | 2.90                         | 3.34       | 0.051                       | 0.038 | ECOS1VA822DA |
| 10000                        | 30 x 35            | 3.20                         | 3.68       | 0.041                       | 0.031 | ECOS1VA103DA |
| 12000                        | 30 x 40            | 3.50                         | 4.03       | 0.035                       | 0.026 | ECOS1VA123DA |
| 15000                        | 30 x 45            | 3.90                         | 4.49       | 0.030                       | 0.022 | ECOS1VA153DA |
| 4700                         | 35 x 20            | 2.00                         | 2.30       | 0.095                       | 0.071 | ECOS1VA472EL |
| 8200                         | 35 x 25            | 2.90                         | 3.34       | 0.051                       | 0.038 | ECOS1VA822EA |
| 10000                        | 35 x 30            | 3.20                         | 3.68       | 0.041                       | 0.031 | ECOS1VA822EA |
| 12000                        | 35 x 30            | 3.50                         | 4.03       | 0.035                       | 0.026 | ECOS1VA123EA |
| 15000                        | 35 x 35            | 3.90                         | 4.49       | 0.030                       | 0.022 | ECOS1VA153EA |
| 18000                        | 35 x 40            | 4.30                         | 4.95       | 0.025                       | 0.019 | ECOS1VA183EA |
| 22000                        | 35 x 50            | 5.00                         | 5.75       | 0.023                       | 0.017 | ECOS1VA223EA |
| 22000                        | 40 x 40            | 5.00                         | 5.75       | 0.023                       | 0.017 | ECOS1VA223FA |
| 27000                        | 40 x 50            | 5.44                         | 6.26       | 0.020                       | 0.015 | ECOS1VA273FA |
| 63 VDC Working, 79 VDC Surge |                    |                              |            |                             |       |              |
| 1200                         | 20 x 30            | 1.40                         | 1.61       | 0.235                       | 0.176 | ECOS1JA122AA |
| 1500                         | 20 x 35            | 1.50                         | 1.73       | 0.188                       | 0.141 | ECOS1JA152AA |
| 1800                         | 20 x 40            | 1.70                         | 1.96       | 0.157                       | 0.117 | ECOS1JA182AA |
| 680                          | 22 x 20            | 0.90                         | 1.04       | 0.463                       | 0.347 | ECOS1JA681BL |
| 680                          | 22 x 25            | 0.90                         | 1.04       | 0.414                       | 0.311 | ECOS1JA681BA |
| 1000                         | 22 x 25            | 1.17                         | 1.35       | 0.282                       | 0.211 | ECOS1JA102BA |
| 1200                         | 22 x 25            | 1.40                         | 1.61       | 0.235                       | 0.176 | ECOS1JA122BA |
| 1500                         | 22 x 30            | 1.50                         | 1.73       | 0.188                       | 0.141 | ECOS1JA152BA |
| 1800                         | 22 x 30            | 1.70                         | 1.96       | 0.157                       | 0.117 | ECOS1JA182BA |
| 2200                         | 22 x 35            | 2.00                         | 2.30       | 0.128                       | 0.096 | ECOS1JA222BA |
| 2700                         | 22 x 40            | 2.20                         | 2.53       | 0.104                       | 0.078 | ECOS1JA272BA |
| 3300                         | 22 x 50            | 2.50                         | 2.88       | 0.090                       | 0.068 | ECOS1JA332BA |
| 1000                         | 25 x 20            | 1.20                         | 1.38       | 0.315                       | 0.236 | ECOS1JA102CL |
| 1800                         | 25 x 25            | 1.70                         | 1.96       | 0.157                       | 0.117 | ECOS1JA182CA |
| 2200                         | 25 x 30            | 2.00                         | 2.30       | 0.128                       | 0.096 | ECOS1JA222CA |
| 2700                         | 25 x 35            | 2.20                         | 2.53       | 0.104                       | 0.078 | ECOS1JA272CA |
| 3300                         | 25 x 40            | 2.50                         | 2.88       | 0.090                       | 0.068 | ECOS1JA332CA |
| 3900                         | 25 x 45            | 2.70                         | 3.11       | 0.077                       | 0.057 | ECOS1JA392CA |
| 4700                         | 25 x 50            | 3.00                         | 3.45       | 0.063                       | 0.048 | ECOS1JA472CA |
| 1500                         | 30 x 20            | 1.30                         | 1.50       | 0.210                       | 0.157 | ECOS1JA152DL |
| 2700                         | 30 x 25            | 2.20                         | 2.53       | 0.104                       | 0.078 | ECOS1JA272DA |
| 3300                         | 30 x 30            | 2.50                         | 2.88       | 0.090                       | 0.068 | ECOS1JA332DA |
| 3900                         | 30 x 35            | 2.70                         | 3.11       | 0.077                       | 0.057 | ECOS1JA392DA |
| 4700                         | 30 x 40            | 3.00                         | 3.45       | 0.063                       | 0.048 | ECOS1JA472DA |
| 5600                         | 30 x 45            | 3.30                         | 3.80       | 0.053                       | 0.040 | ECOS1JA562DA |
| 6800                         | 30 x 50            | 3.60                         | 4.14       | 0.049                       | 0.037 | ECOS1JA682DA |
| 2200                         | 35 x 20            | 1.50                         | 1.73       | 0.143                       | 0.107 | ECOS1JA222EL |
| 3300                         | 35 x 25            | 2.50                         | 2.88       | 0.090                       | 0.068 | ECOS1JA332EA |
| 3900                         | 35 x 30            | 2.70                         | 3.11       | 0.077                       | 0.057 | ECOS1JA392EA |
| 4700                         | 35 x 30            | 3.00                         | 3.45       | 0.063                       | 0.048 | ECOS1JA472EA |
| 5600                         | 35 x 35            | 3.30                         | 3.80       | 0.053                       | 0.040 | ECOS1JA562EA |
| 6800                         | 35 x 40            | 3.60                         | 4.14       | 0.049                       | 0.037 | ECOS1JA682EA |
| 8200                         | 35 x 45            | 3.90                         | 4.49       | 0.040                       | 0.030 | ECOS1JA822EA |
| 10000                        | 35 x 50            | 4.40                         | 5.06       | 0.033                       | 0.028 | ECOS1JA103EA |
| 12000                        | 40 x 40            | 4.52                         | 5.20       | 0.030                       | 0.026 | ECOS1JA123FA |
| 15000                        | 40 x 50            | 4.80                         | 5.52       | 0.027                       | 0.023 | ECOS1JA153FA |

## TS-HA Standard Ratings (continued)

| Cap.<br>( $\mu$ F)            | Size (mm)<br>D x L | Max 105°C R.C. ( $A_{rms}$ ) |            | 20°C ESR ( $\Omega$ , max.) |       | Panasonic    |
|-------------------------------|--------------------|------------------------------|------------|-----------------------------|-------|--------------|
|                               |                    | 120Hz                        | 10k-100kHz | 120Hz                       | 20kHz | Part Number  |
| 80 VDC Working, 100 VDC Surge |                    |                              |            |                             |       |              |
| 820                           | 20 x 30            | 1.20                         | 1.38       | 0.222                       | 0.145 | ECOS1KA821AA |
| 1000                          | 20 x 35            | 1.30                         | 1.50       | 0.182                       | 0.119 | ECOS1KA102AA |
| 1200                          | 20 x 40            | 1.50                         | 1.73       | 0.166                       | 0.116 | ECOS1KA122AA |
| 470                           | 22 x 20            | 0.80                         | 0.92       | 0.459                       | 0.298 | ECOS1KA471BL |
| 470                           | 22 x 25            | 0.80                         | 0.92       | 0.388                       | 0.272 | ECOS1KA471BA |
| 680                           | 22 x 25            | 1.00                         | 1.15       | 0.268                       | 0.188 | ECOS1KA681BA |
| 820                           | 22 x 25            | 1.20                         | 1.38       | 0.222                       | 0.145 | ECOS1KA821BA |
| 1000                          | 22 x 30            | 1.30                         | 1.50       | 0.182                       | 0.119 | ECOS1KA102BA |
| 1200                          | 22 x 30            | 1.50                         | 1.73       | 0.166                       | 0.116 | ECOS1KA122BA |
| 1500                          | 22 x 35            | 1.70                         | 1.96       | 0.133                       | 0.093 | ECOS1KA152BA |
| 1800                          | 22 x 40            | 1.80                         | 2.07       | 0.111                       | 0.077 | ECOS1KA182BA |
| 2200                          | 22 x 45            | 2.10                         | 2.42       | 0.090                       | 0.063 | ECOS1KA222BA |
| 680                           | 25 x 20            | 1.00                         | 1.15       | 0.317                       | 0.206 | ECOS1KA681CL |
| 1000                          | 25 x 25            | 1.30                         | 1.50       | 0.182                       | 0.119 | ECOS1KA102CA |
| 1200                          | 25 x 25            | 1.50                         | 1.73       | 0.166                       | 0.116 | ECOS1KA122CA |
| 1500                          | 25 x 30            | 1.70                         | 1.96       | 0.133                       | 0.093 | ECOS1KA152CA |
| 1800                          | 25 x 35            | 1.80                         | 2.07       | 0.111                       | 0.077 | ECOS1KA182CA |
| 2200                          | 25 x 35            | 2.10                         | 2.42       | 0.090                       | 0.063 | ECOS1KA222CA |
| 2700                          | 25 x 45            | 2.40                         | 2.76       | 0.074                       | 0.055 | ECOS1KA272CA |
| 3300                          | 25 x 50            | 2.60                         | 2.99       | 0.065                       | 0.049 | ECOS1KA332CA |
| 1000                          | 30 x 20            | 1.20                         | 1.38       | 0.216                       | 0.140 | ECOS1KA102DL |
| 1800                          | 30 x 25            | 1.80                         | 2.07       | 0.111                       | 0.077 | ECOS1KA182DA |
| 2200                          | 30 x 30            | 2.10                         | 2.42       | 0.090                       | 0.063 | ECOS1KA222DA |
| 2700                          | 30 x 35            | 2.40                         | 2.76       | 0.074                       | 0.055 | ECOS1KA272DA |
| 3300                          | 30 x 40            | 2.60                         | 2.99       | 0.065                       | 0.049 | ECOS1KA332DA |
| 3900                          | 30 x 45            | 3.00                         | 3.45       | 0.060                       | 0.045 | ECOS1KA392DA |
| 4700                          | 30 x 50            | 3.30                         | 3.80       | 0.049                       | 0.037 | ECOS1KA472DA |
| 1500                          | 35 x 20            | 1.40                         | 1.61       | 0.155                       | 0.108 | ECOS1KA152EL |
| 2200                          | 35 x 25            | 2.10                         | 2.42       | 0.090                       | 0.063 | ECOS1KA222EA |
| 2700                          | 35 x 30            | 2.40                         | 2.76       | 0.074                       | 0.055 | ECOS1KA272EA |
| 3300                          | 35 x 30            | 2.60                         | 2.99       | 0.065                       | 0.049 | ECOS1KA332EA |
| 3900                          | 35 x 35            | 3.00                         | 3.45       | 0.060                       | 0.045 | ECOS1KA392EA |
| 4700                          | 35 x 40            | 3.30                         | 3.80       | 0.049                       | 0.037 | ECOS1KA472EA |
| 5600                          | 35 x 45            | 3.70                         | 4.26       | 0.050                       | 0.038 | ECOS1KA562EA |
| 6800                          | 35 x 50            | 3.90                         | 4.49       | 0.041                       | 0.031 | ECOS1KA682EA |
| 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 |

| Cap.<br>( $\mu$ F)             | Size (mm)<br>D x L | Max 105°C R.C. ( $A_{rms}$ ) |            | 20°C ESR ( $\Omega$ , max.) |       | Panasonic    |
|--------------------------------|--------------------|------------------------------|------------|-----------------------------|-------|--------------|
|                                |                    | 120Hz                        | 10k-100kHz | 120Hz                       | 20kHz | Part Number  |
| 100 VDC Working, 125 VDC Surge |                    |                              |            |                             |       |              |
| 560                            | 20 x 30            | 1.10                         | 1.65       | 0.296                       | 0.178 | ECOS2AA561AA |
| 820                            | 20 x 35            | 1.40                         | 2.10       | 0.202                       | 0.121 | ECOS2AA821AA |
| 1000                           | 20 x 40            | 1.70                         | 2.55       | 0.182                       | 0.109 | ECOS2AA102AA |
| 330                            | 22 x 20            | 0.80                         | 1.20       | 0.653                       | 0.392 | ECOS2AA331BL |
| 330                            | 22 x 25            | 0.80                         | 1.20       | 0.553                       | 0.332 | ECOS2AA331BA |
| 470                            | 22 x 25            | 0.92                         | 1.38       | 0.388                       | 0.233 | ECOS2AA471BA |
| 560                            | 22 x 25            | 1.10                         | 1.65       | 0.296                       | 0.178 | ECOS2AA561BA |
| 820                            | 22 x 30            | 1.40                         | 2.10       | 0.202                       | 0.121 | ECOS2AA821BA |
| 1000                           | 22 x 35            | 1.70                         | 2.55       | 0.182                       | 0.109 | ECOS2AA102BA |
| 1200                           | 22 x 40            | 1.80                         | 2.70       | 0.152                       | 0.091 | ECOS2AA122BA |
| 1500                           | 22 x 45            | 2.10                         | 3.15       | 0.122                       | 0.073 | ECOS2AA152BA |
| 470                            | 25 x 20            | 1.00                         | 1.50       | 0.459                       | 0.275 | ECOS2AA471CL |
| 820                            | 25 x 25            | 1.40                         | 2.10       | 0.202                       | 0.121 | ECOS2AA821CA |
| 1000                           | 25 x 30            | 1.70                         | 2.55       | 0.182                       | 0.109 | ECOS2AA102CA |
| 1200                           | 25 x 35            | 1.80                         | 2.70       | 0.152                       | 0.091 | ECOS2AA122CA |
| 1500                           | 25 x 40            | 2.10                         | 3.15       | 0.122                       | 0.079 | ECOS2AA152CA |
| 1800                           | 25 x 45            | 2.30                         | 3.45       | 0.111                       | 0.072 | ECOS2AA182CA |
| 2200                           | 25 x 50            | 2.60                         | 3.90       | 0.090                       | 0.059 | ECOS2AA222CA |
| 680                            | 30 x 20            | 1.10                         | 1.65       | 0.317                       | 0.190 | ECOS2AA681DL |
| 1200                           | 30 x 25            | 1.80                         | 2.70       | 0.152                       | 0.091 | ECOS2AA122DA |
| 1500                           | 30 x 30            | 2.10                         | 3.15       | 0.122                       | 0.079 | ECOS2AA152DA |
| 1800                           | 30 x 35            | 2.30                         | 3.45       | 0.111                       | 0.072 | ECOS2AA182DA |
| 2200                           | 30 x 40            | 2.60                         | 3.90       | 0.090                       | 0.059 | ECOS2AA222DA |
| 2700                           | 30 x 45            | 2.90                         | 4.35       | 0.080                       | 0.052 | ECOS2AA272DA |
| 3300                           | 30 x 50            | 3.20                         | 4.80       | 0.075                       | 0.053 | ECOS2AA332DA |
| 1000                           | 35 x 20            | 1.20                         | 1.80       | 0.216                       | 0.129 | ECOS2AA102EL |
| 1500                           | 35 x 25            | 2.10                         | 3.15       | 0.122                       | 0.079 | ECOS2AA152EA |
| 1800                           | 35 x 30            | 2.30                         | 3.45       | 0.111                       | 0.072 | ECOS2AA182EA |
| 2200                           | 35 x 30            | 2.60                         | 3.90       | 0.090                       | 0.059 | ECOS2AA222EA |
| 2700                           | 35 x 35            | 2.90                         | 4.35       | 0.080                       | 0.052 | ECOS2AA272EA |
| 3300                           | 35 x 40            | 3.20                         | 4.80       | 0.075                       | 0.053 | 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 |
| 4700                           | 40 x 40            | 3.80                         | 5.70       | 0.053                       | 0.040 | ECOS2AA472FA |
| 6800                           | 40 x 50            | 4.57                         | 6.86       | 0.037                       | 0.027 | ECOS2AA682FA |

| 160 VDC Working, 200 VDC Surge |         |      |      |       |       |              |
|--------------------------------|---------|------|------|-------|-------|--------------|
| 220                            | 20 x 25 | 1.00 | 1.40 | 0.829 | 0.373 | ECOS2CA221AA |
| 270                            | 20 x 30 | 1.10 | 1.54 | 0.675 | 0.304 | ECOS2CA271AA |
| 330                            | 20 x 35 | 1.20 | 1.68 | 0.653 | 0.294 | ECOS2CA331AA |
| 390                            | 20 x 40 | 1.30 | 1.82 | 0.468 | 0.210 | ECOS2CA391AA |
| 150                            | 22 x 20 | 0.55 | 0.77 | 1.437 | 0.647 | ECOS2CA151BL |
| 150                            | 22 x 25 | 0.61 | 0.85 | 1.216 | 0.547 | ECOS2CA151BA |
| 220                            | 22 x 25 | 0.90 | 1.26 | 0.829 | 0.373 | ECOS2CA221BA |
| 270                            | 22 x 25 | 1.10 | 1.54 | 0.675 | 0.304 | ECOS2CA271BA |
| 330                            | 22 x 30 | 1.20 | 1.68 | 0.553 | 0.249 | ECOS2CA331BA |
| 390                            | 22 x 30 | 1.30 | 1.82 | 0.553 | 0.249 | ECOS2CA391BA |
| 470                            | 22 x 35 | 1.40 | 1.96 | 0.529 | 0.238 | ECOS2CA471BA |
| 560                            | 22 x 40 | 1.50 | 2.10 | 0.385 | 0.173 | ECOS2CA561BA |
| 680                            | 22 x 45 | 1.70 | 2.38 | 0.317 | 0.143 | ECOS2CA681BA |
| 220                            | 25 x 20 | 0.75 | 1.05 | 0.980 | 0.441 | ECOS2CA221CL |
| 390                            | 25 x 25 | 1.30 | 1.82 | 0.553 | 0.249 | ECOS2CA391CA |
| 470                            | 25 x 30 | 1.40 | 1.96 | 0.459 | 0.206 | ECOS2CA471CA |
| 560                            | 25 x 30 | 1.50 | 2.10 | 0.385 | 0.173 | ECOS2CA561CA |
| 680                            | 25 x 35 | 1.70 | 2.38 | 0.317 | 0.143 | ECOS2CA681CA |
| 820                            | 25 x 40 | 2.00 | 2.80 | 0.263 | 0.118 | ECOS2CA821CA |
| 1000                           | 25 x 45 | 2.20 | 3.08 | 0.216 | 0.108 | ECOS2CA102CA |
| 1200                           | 25 x 50 | 2.30 | 3.22 | 0.180 | 0.090 | ECOS2CA122CA |
| 330                            | 30 x 20 | 1.00 | 1.40 | 0.553 | 0.249 | ECOS2CA331DL |
| 560                            | 30 x 25 | 1.50 | 2.10 | 0.385 | 0.173 | ECOS2CA561DA |
| 680                            | 30 x 30 | 1.70 | 2.38 | 0.317 | 0.143 | ECOS2CA681DA |
| 820                            | 30 x 30 | 2.00 | 2.80 | 0.263 | 0.118 | ECOS2CA821DA |
| 1000                           | 30 x 35 | 2.20 | 3.08 | 0.216 | 0.108 | ECOS2CA102DA |
| 1200                           | 30 x 40 | 2.30 | 3.22 | 0.180 | 0.090 | ECOS2CA122DA |
| 1500                           | 30 x 45 | 2.50 | 3.50 | 0.166 | 0.083 | ECOS2CA152DA |
| 1800                           | 30 x 50 | 2.70 | 3.78 | 0.138 | 0.083 | ECOS2CA182DA |
| 470                            | 35 x 20 | 1.15 | 1.61 | 0.459 | 0.206 | ECOS2CA471EL |
| 1500                           | 35 x 35 | 2.50 | 3.50 | 0.166 | 0.083 | ECOS2CA152EA |
| 1800                           | 35 x 40 | 2.70 | 3.78 | 0.138 | 0.069 | ECOS2CA182EA |
| 2200                           | 35 x 50 | 2.90 | 4.06 | 0.113 | 0.057 | ECOS2CA222EA |

| 200 VDC Working, 250 VDC Surge |         |      |      |       |       |              |
|--------------------------------|---------|------|------|-------|-------|--------------|
| 220                            | 20 x 30 | 1.00 | 1.40 | 0.754 | 0.339 | ECOS2DA221AA |
| 270                            | 20 x 35 | 1.10 | 1.54 | 0.614 | 0.276 | ECOS2DA271AA |
| 330                            | 20 x 40 | 1.20 | 1.68 | 0.502 | 0.226 | ECOS2DA331AA |
| 100                            | 22 x 20 | 0.50 | 0.70 | 1.989 | 0.895 | ECOS2DA101BL |
| 100                            | 22 x 25 | 0.50 | 0.70 | 1.658 | 0.746 | ECOS2DA101BA |
| 150                            | 22 x 25 | 0.68 | 0.95 | 1.105 | 0.497 | ECOS2DA151BA |
| 220                            | 22 x 25 | 1.00 | 1.40 | 0.754 | 0.339 | ECOS2DA221BA |
| 270                            | 22 x 30 | 1.10 | 1.54 | 0.614 | 0.276 | ECOS2DA271BA |
| 330                            | 22 x 30 | 1.20 | 1.68 | 0.502 | 0.226 | ECOS2DA331BA |
| 390                            | 22 x 35 | 1.30 | 1.82 | 0.425 | 0.191 | ECOS2DA391BA |
| 470                            | 22 x 40 | 1.40 | 1.96 | 0.353 | 0.159 | ECOS2DA471BA |
| 560                            | 22 x 45 | 1.50 | 2.10 | 0.296 | 0.133 | ECOS2DA561BA |
| 150                            | 25 x 20 | 0.65 | 0.91 | 1.326 | 0.597 | ECOS2DA151CL |
| 270                            | 25 x 25 | 1.10 | 1.54 | 0.614 | 0.276 | ECOS2DA271CA |
| 330                            | 25 x 25 | 1.20 | 1.68 | 0.502 | 0.226 | ECOS2DA331CA |
| 390                            | 25 x 30 | 1.30 | 1.82 | 0.425 | 0.191 | ECOS2DA391CA |
| 470                            | 25 x 35 | 1.40 | 1.96 | 0.353 | 0.159 | ECOS2DA471CA |
| 560                            | 25 x 35 | 1.50 | 2.10 | 0.296 | 0.133 | ECOS2DA561CA |
| 680                            | 25 x 40 | 1.70 | 2.38 | 0.244 | 0.110 | ECOS2DA681CA |
| 820                            | 25 x 50 | 2.00 | 2.80 | 0.222 | 0.111 | ECOS2DA821CA |
| 220                            | 30 x 20 | 0.87 | 1.22 | 0.904 | 0.407 | ECOS2DA221DL |
| 390                            | 30 x 25 | 1.30 | 1.82 | 0.425 | 0.191 | ECOS2DA391DA |
| 470                            | 30 x 25 | 1.40 | 1.96 | 0.353 | 0.159 | ECOS2DA471DA |
| 560                            | 30 x 30 | 1.50 | 2.10 | 0.296 | 0.133 | ECOS2DA561DA |
| 680                            | 30 x 30 | 1.70 | 2.38 | 0.244 | 0.110 | ECOS2DA681DA |
| 820                            | 30 x 35 | 2.00 | 2.80 | 0.222 | 0.111 | ECOS2DA821DA |
| 1000                           | 30 x 45 | 2.20 | 3.08 | 0.199 | 0.099 | ECOS2DA102DA |
| 1200                           | 30 x 50 | 2.30 | 3.22 | 0.166 | 0.083 | ECOS2DA122DA |
| 330                            | 35 x 20 | 1.10 | 1.54 | 0.603 | 0.271 | ECOS2DA331EL |
| 820                            | 35 x 30 | 2.00 | 2.80 | 0.222 | 0.111 | ECOS2DA821EA |
| 1000                           | 35 x 35 | 2.20 | 3.08 | 0.199 | 0.099 | ECOS2DA102EA |
| 1200                           | 35 x 40 | 2.30 | 3.22 | 0.166 | 0.083 | ECOS2DA122EA |
| 1500                           | 35 x 50 | 2.50 | 3.50 | 0.144 | 0.072 | ECOS2DA152EA |

## TS-HA Standard Ratings (continued)

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