



## Power Ring Film Capacitor™ 1000 µF, 600 VDC



### Electrical Specifications

**SBE Part #:** 700D10896-348

**Capacitance/Tolerance:** 1000 µF ±10%

**DC Voltage Rating:** 600 VDC

**Dielectric/Construction:** Metallized polypropylene.  
Single section design,  
non-inductively wound

**Dielectric Withstand:** Unit shall withstand a DC  
potential of 750 Volts for two  
minutes

**Insulation Resistance:** 100 MΩ Min at +25°C

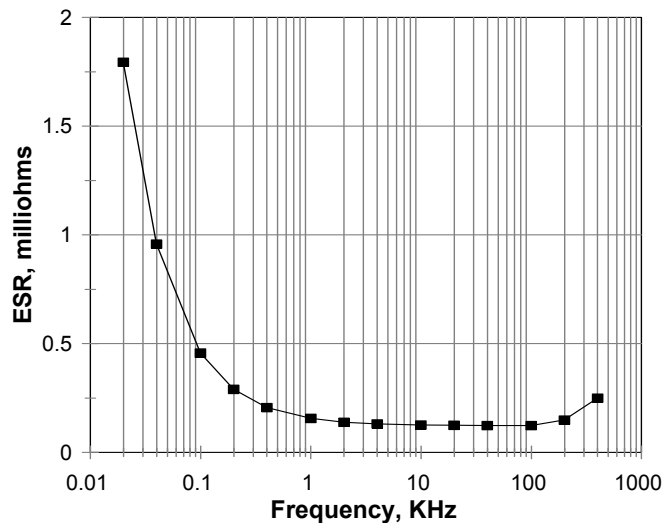
**ESL:** Less than ~ 5 nH in a suitable  
coplanar bus structure

**Operating Temperature:** -40°C to +85°C at full  
DC voltage rating

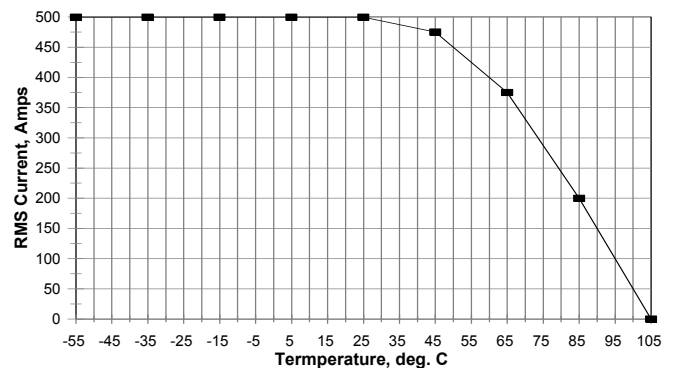
**Voltage, Temperature  
De-rating:** De-rate voltage linearly to 300  
VDC from +85°C to +105°C

**Peak Current Rating:** 10000 Amps maximum

### Estimated ESR vs. Frequency:



**RMS Current Rating:** Maximum recommended  
continuous RMS Current vs.  
Temperature at 10 KHz:





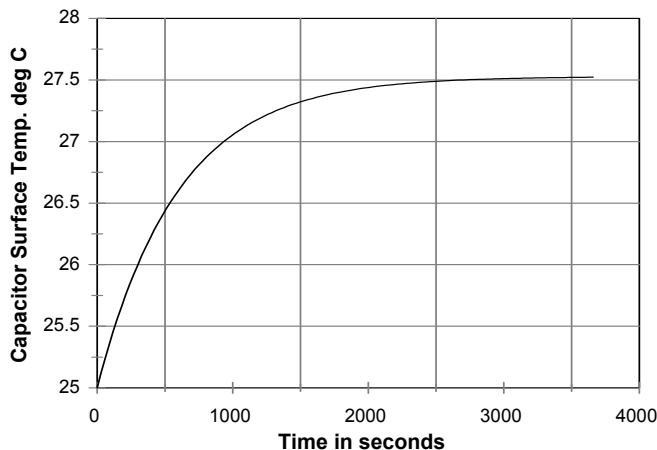
## Thermal Specifications

Below are two representations of “Capacitor Surface Temperature over Time” for two specific Thermal Resistances of 1°C/W and 0.5°C/W. Notes regarding these graphs:

- The thermal resistance is that from capacitor to application. This is a function of the application environment, not the capacitor itself.
- The capacitor can handle extreme current for small duty ratios. Trise occurs very slowly. This is because the capacitor has a high specific heat.
- These charts can be adapted for other currents by multiplying y axis values for any time by  $(I_{app}/200)^2$
- Internal capacitor Trise is added to the capacitor surface/terminal temperature.
- For 200 ARMS the assumed 10°C internal Trise is very conservative based on simulation results and verification measurements.
- Terminals are assumed to be at case temperature.

### Sample 1.

Capacitor surface temperature rise above application environment @ 200 Amps RMS current load, 10 KHz. Thermal resistance = 0.5°C/W:

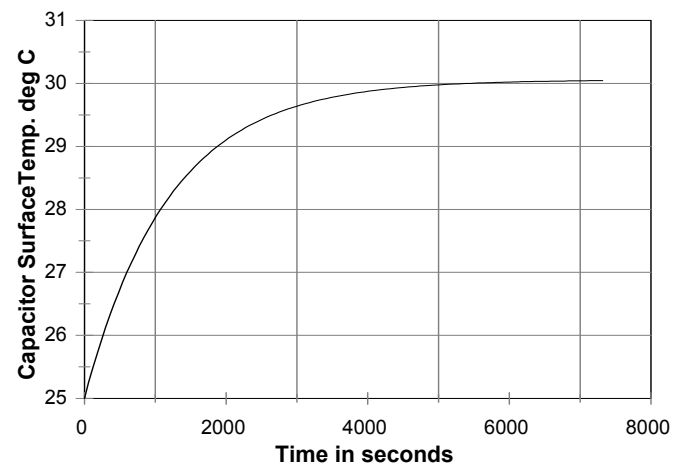


## Mechanical Specifications

- Dimensions:** Refer to layout details
- Terminals:** Tin plated copper, 0.032” thick
- Encapsulation:** Molded polymeric case, potted with RTV silicone
- Marking:**
- |                |                                                  |
|----------------|--------------------------------------------------|
| SBE            | SBE Company Identification                       |
| 700D348        | SBE “Short Form” Part Number                     |
| 1000 μF ±10%   | Capacitance value and tolerance                  |
| 600 VDC        | DC Voltage Rating                                |
| yyww           | Weekly date code (i.e. 0915 = 15th week of 2009) |
| yyww-lot#-unit | 12-digit serial number                           |

### Sample 2.

Capacitor surface temperature rise above application environment @ 200 Amps RMS current load, 10 KHz. Thermal resistance = 1°C/W:





# Power Ring Film Capacitors™

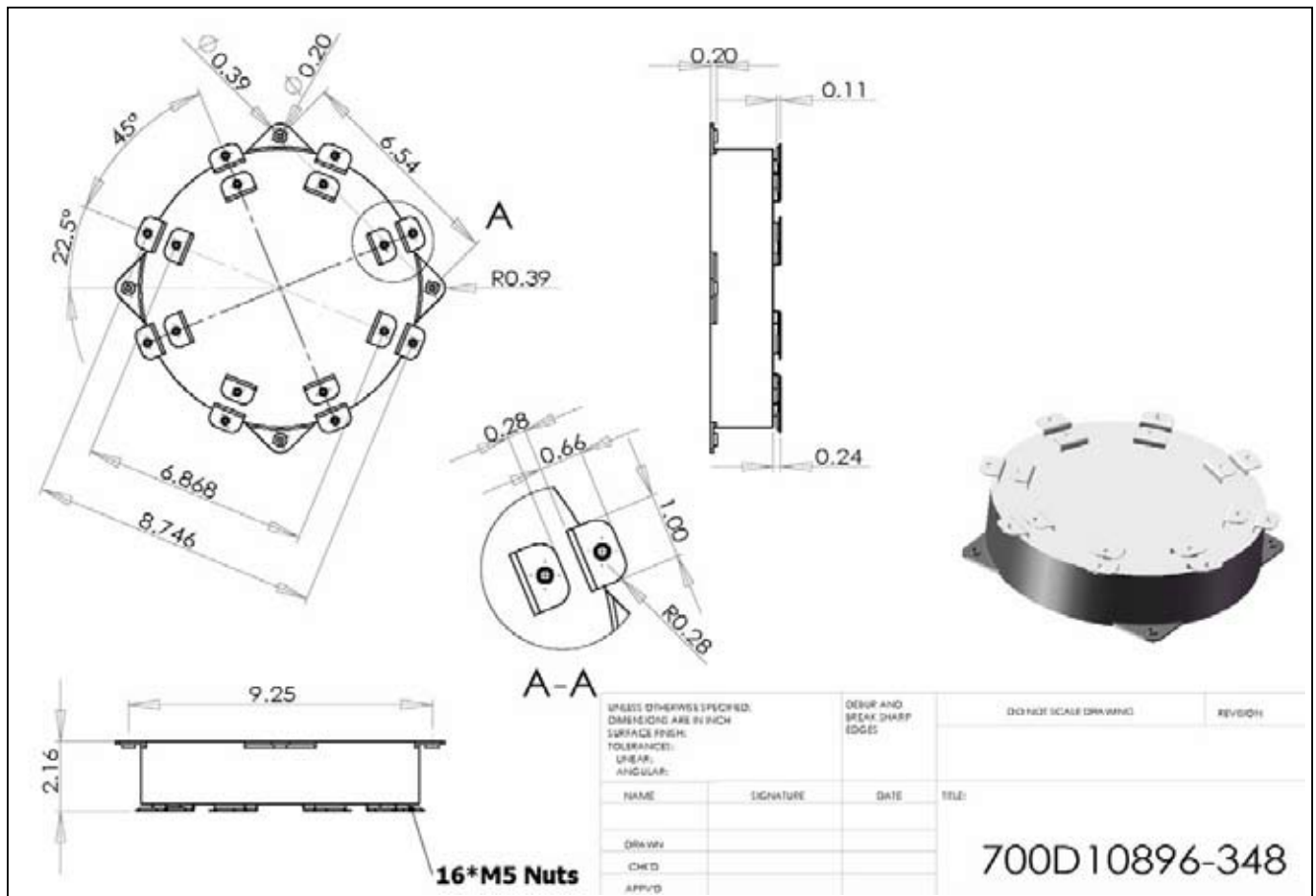
SBE Part #: 700D10896-348

## Mechanical Mounting and additional thermal notes:

This capacitor is optimized for extremely low self inductance when connected to a suitable coplanar bus structure. When so connected, the capacitor is very rigidly attached to such a structure and thus does not necessarily need to be mounted to a chassis. However, the capacitor case can be attached to an application surface/heat sink, etc. if desired. When so mounted, the capacitor can be part of the bus structure support. Use of thermal interface compound between the capacitor case and application surface/heat sink will assist with removal of capacitor and bus heat. Note that the capacitor internal heat is VERY small, and

other bus structure heat sources are very likely significantly higher than the heat added to the bus by the capacitor. Capacitor dissipation is approximately 5W at 200ARMS, from 1-100KHz. It is highly recommended to use infrared thermal imaging from a system cold start to determine the location and relative magnitude of thermal input to the bus. The capacitor may well function as a thermal conduit for bus structure heat, and it will be very possible that the capacitor internal hot spot is less than the terminal temperature. Thermal contour maps are available for some representative conditions.

## Layout Details:



Contact SBE Inc. to discuss your specific requirements.

At the Leading Edge of Film Capacitor Technology®



## Advantages of Power Ring DC Link Capacitors

- Ability to handle higher ripple currents with less capacitance, weight, and volume
- Potential use of 105°C ICE coolant for power electronics cooling
- Zero capacitor maintenance for the life of the inverter and longer inverter MTBF due to uniform current density, inductance, and dissipation
- Elimination of IGBT overshoot and snubber capacitors
- Most effective isolation of DC storage or supply from AC switching artifacts
- Distributed 'Crown Terminal' architecture allowing for operation with uniform current density and simplified assembly
- Smaller inverter packaging
- Overall system cost savings

**The 700D10896-348 Power Ring is a 600VDC, 1000uF DC Link Capacitor rated for a 10°C Trise with 200 ARMS of applied current at 85°C, ESR at 20kHz is 0.125 milliohms with an ESL of ~15nH.**

The SBE Power Ring Film Capacitors™ utilize traditionally available and economical Polypropylene and Polyester capacitor dielectric films. However, the *power of the shape™* allows for performance which has been unachievable in the Film Capacitor industry to date.

## Power Ring System Performance

The combination of lowest available Trise, ESR and ESL coupled with highest ripple current handling capability enable the development of industry leading inverter designs with unbeatable performance and reliability.

## Product Highlights

*Lowest available Trise per unit RMS:*

The **700D10896-348** Power Ring DC Link capacitor will handle an impressive 500 ARMS continuous to 25°C and a very respectable 200 ARMS continuous at 85°C.

*Lowest available ESL, 10-15nH proven with integrated bus*

The **700D10896-348** ESL of ~15nH supports switching frequencies of 20kHz and above without inducing IGBT overshoot and when properly integrated to the bus eliminates the need for IGBT snubber capacitors.

*Lowest available ESR, 0.125 milliohms typical*

Crown terminal architecture provides for a multitude of current paths which allows the monolithic capacitor to function as a distributed element with a much lower ESR than an equivalent capacitor with a single pair of terminals.

## Crown Terminal Architecture

The **700D10896-348** features distributed coplanar terminals designed for highly integrated low inductance electrical connection with laminated buses or PCB's. The terminal architecture further advances the state of art in DC link capacitor technology by allowing the monolithic capacitor section to function as a distributed element, eliminate localized hotspots at the terminal location due to 'current hogging' and reduces the ESR by providing a multitude of paths for the current to flow through.

An additional benefit of the Crown Terminal architecture is the prevention of eddy current induced heating of the metallization on the dielectric film which enables operation of the **700D10896-348** at high switching frequencies without experiencing eddy current induced Trises in the capacitor, another SBE first in the world of film capacitor technology.

The **700D10896-348** offers simplified assembly over the 'six-pack' approach to DC Link to DC bus integration as only one capacitor needs to be mounted and the **700D10896-348** is supplied with mechanical as well as electrical connection for direct connection to chill plates or the enclosure bulkhead. Additionally, the **700D10896-348** enables reductions in inventory stock due to reduced part count.

#SBE-PR-348-03/10