Power Ring Film Capacitor™
1000 µF, 600 Vdc

The 700D10896-348 Power Ring is a 600Vdc, 1000 µF DC Link Capacitor with an ESR of 125 micro-Ohms at 20kHz and an ESL of less than 5nH.

Electrical Specifications

SBE Part #: 700D10896-348

Capacitance/Tolerance: 1000 µF ±10%

DC Voltage Rating: 600 Vdc

Dielectric/Construction: Metallized polypropylene. Single section design

Dielectric Withstand: Units 100% tested at DC potential of 750 Volts for two minutes at 25°C

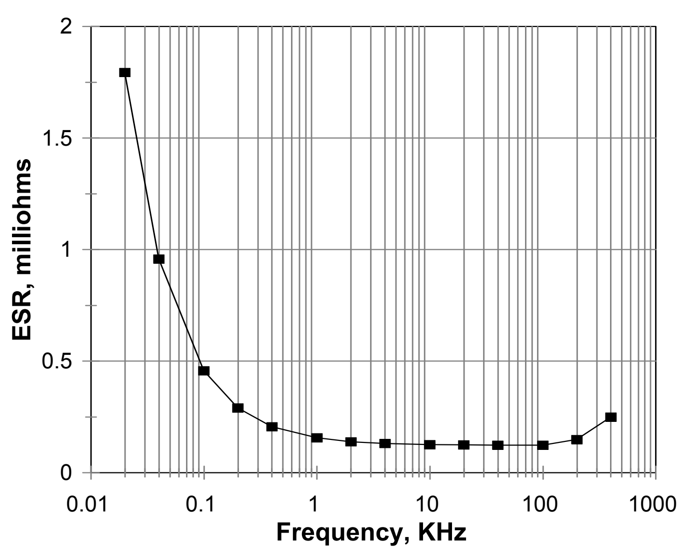
ESL: Less than 5 nH in a suitable laminar bus structure

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

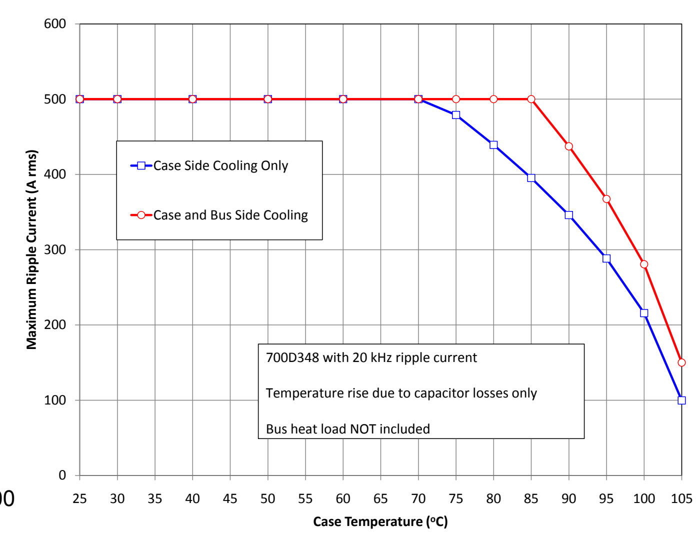
Voltage, Temperature De-rating: De-rate voltage linearly to 400 Vdc from +85°C to +105°C

System Fault Current Rating (external to the capacitor): 10,000 Amps maximum

Typical ESR vs. Frequency:



RMS Current Rating:



SBE reserves the right to amend design data

Thermal Specifications

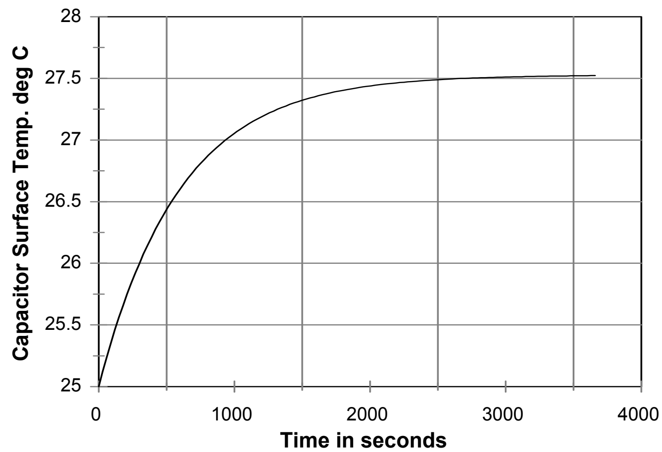
Here are two representations of "Capacitor Surface Temperature over Time" for two specific Thermal Resistances of 1°C/W and 0.5°C/W.

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 $(Iapp/200)^2$
- Internal capacitor Trise is added to the capacitor surface/terminal temperature.
- Terminals are assumed to be at case temperature.

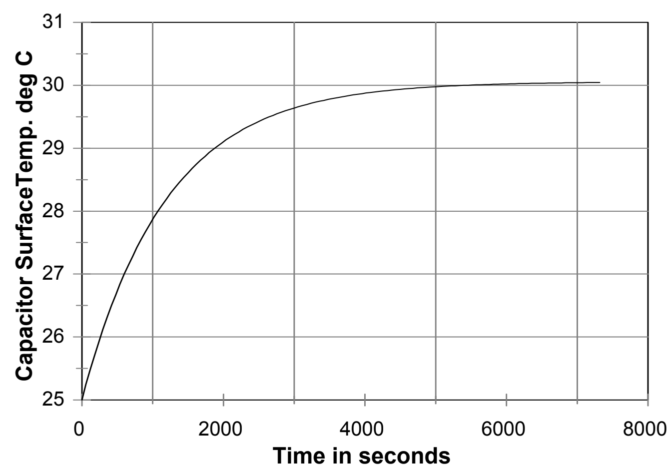
Sample 1.

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



Sample 2.

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



Mechanical Specifications

Dimensions:	Refer to layout details
Terminals:	Tin plated copper, 0.032" thick
Encapsulation:	Molded polymer case, potted with RTV
Marking:	
SBE	SBE company identification
700D348	SBE "short form" part number
1000 µF ±10%	Capacitance value and tolerance
600 Vdc	DC voltage rating
yyww-lot#-unit	12-digit serial number (date code, lot number, unit number)

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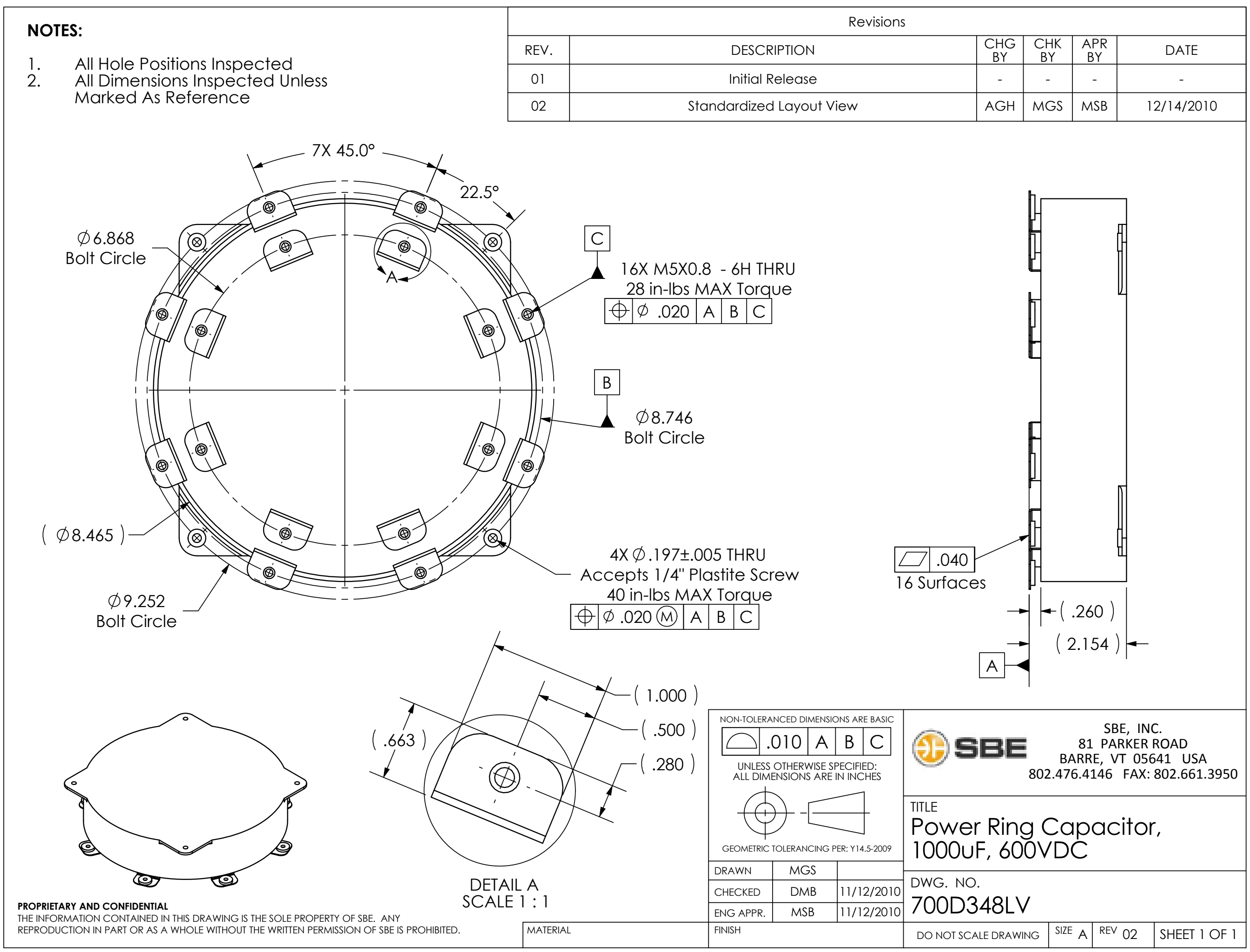
Mechanical Mounting and Additional Thermal Notes:

This capacitor is optimized for extremely low self inductance when connected to a suitable laminar 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 heating 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.

Advantages of Power Ring DC Link Capacitors

- Ability to handle higher ripple currents with less capacitance, weight, and volume
- Use of 105°C ICE coolant for power electronics cooling
- Demonstrated MTTF >> 20,000 hours for realistic operating conditions, due to lower losses and better thermal performance
- Minimization of IGBT overshoot and elimination of the need for additional snubber capacitors
- Most effective isolation of DC storage or supply from AC switching artifacts
- Lowest industry ESL at <5nH typical with a properly integrated bus structure
- Smaller inverter packaging
- Overall system cost savings
- Capacitance from 400 µF to 2500 µF and voltages from 250 Vdc to 1200 Vdc

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 both thermal and electrical 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.

Lowest available Trise for a given ripple current

Lowest available ESL, less than 5nH demonstrated with optimal integrated bus

Lowest available ESR, less than 150 micro-Ohms 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 array of smaller parts. SBE has developed a next generation capacitor simulation tool that allows accurate calculation of hotspot temperature to allow optimal rating with excellent reliability.

Integrating the Power Ring in an Existing Design

The “stacked” inverter design evolves from modifying a typical automotive inverter by utilizing the excess space left above the IGBT module (figure 1). By bending the end of the laminar bus plate, the IBGT, die, cooling plate, and the ring capacitor are “stacked” on top of each other in a symmetrical fashion. The ring capacitor is placed underneath the cooling plate. The cooling plate is shared with the IGBT module which is mounted on the top.

Figure 1

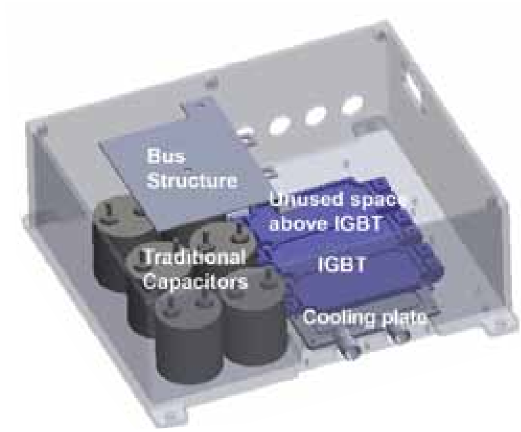


Figure 2

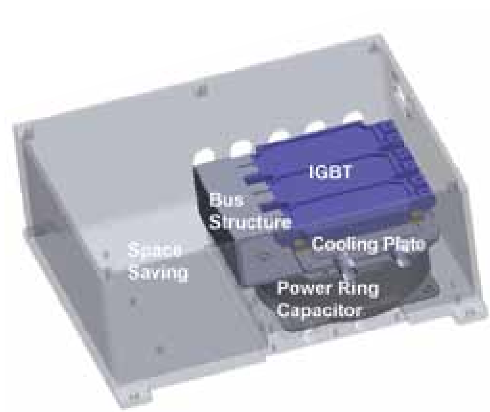


Figure 2 shows the “stacked” inverter design after the integration of the ring capacitor and the laminar bus plate. By now combining both aspects of vertical integration and the low temperature rise characteristics of the capacitors, an increase to 50% or more volume reduction is realistically possible. These improvements clearly translate into weight and cost reductions.

#SBE-PR-348-01/11

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