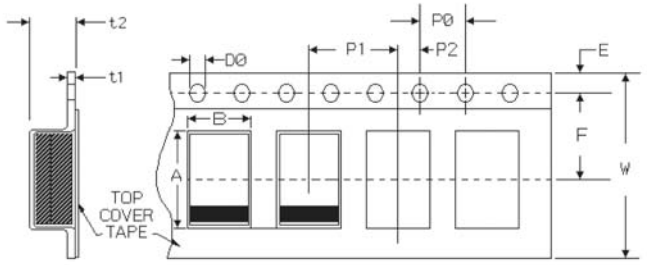
Tape Specifications

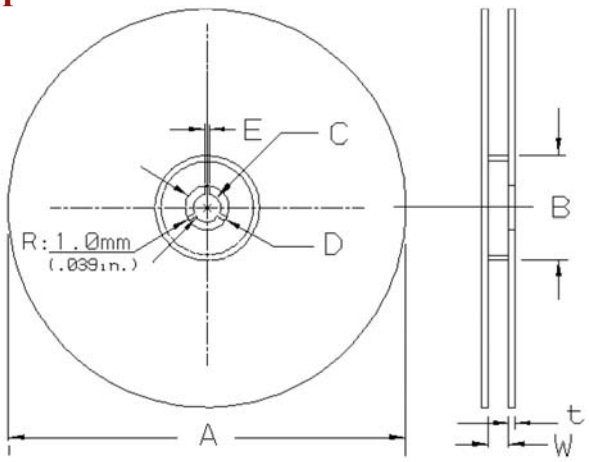


SPA Type	ESRD	ESRE	ESRH	SPA
t_2 = H + 0.3 mm ±0.2 mm				

W ±0.3	E	F	D⁻ + 0.1/–0.0	$P_ø$	P_1 ±0.2	P_2	A ±0.2	B ±0.2	t_1
12.0	1.8	5.5	1.5	4.0	8.0	2.0	7.7	4.6	0.4

Tol.: ± mm unless otherwise specified

Reel Specifications

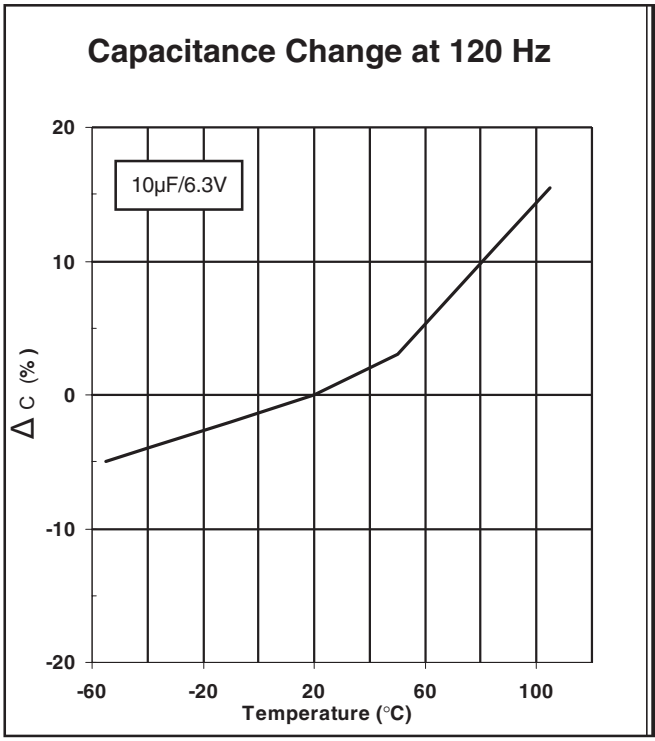


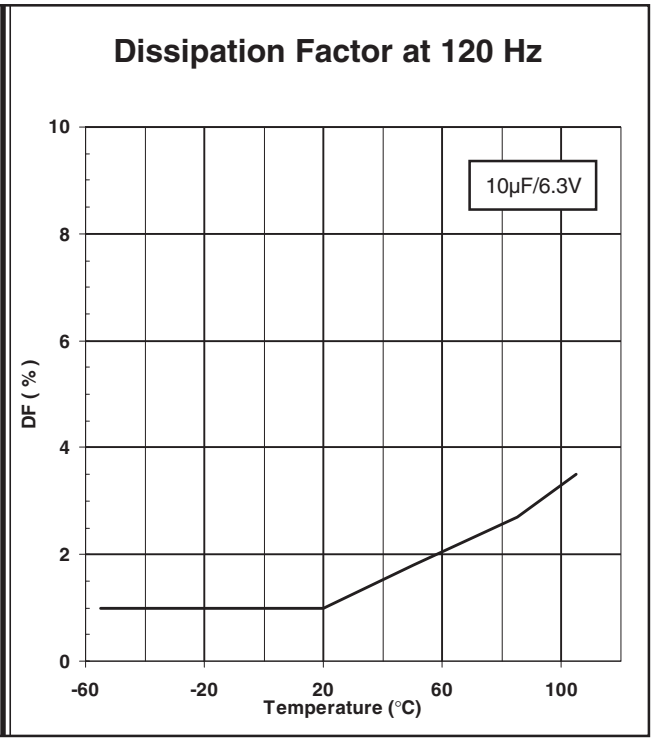
A ±0.2	B Min.	C ±0.5	D ±0.8	E ±0.5	W ±1.0	t
333.0	50.0	13.0	21.0	2.0	14.0	3.0

Design Kits

Design kits containing various ratings are available through the CDE web site.

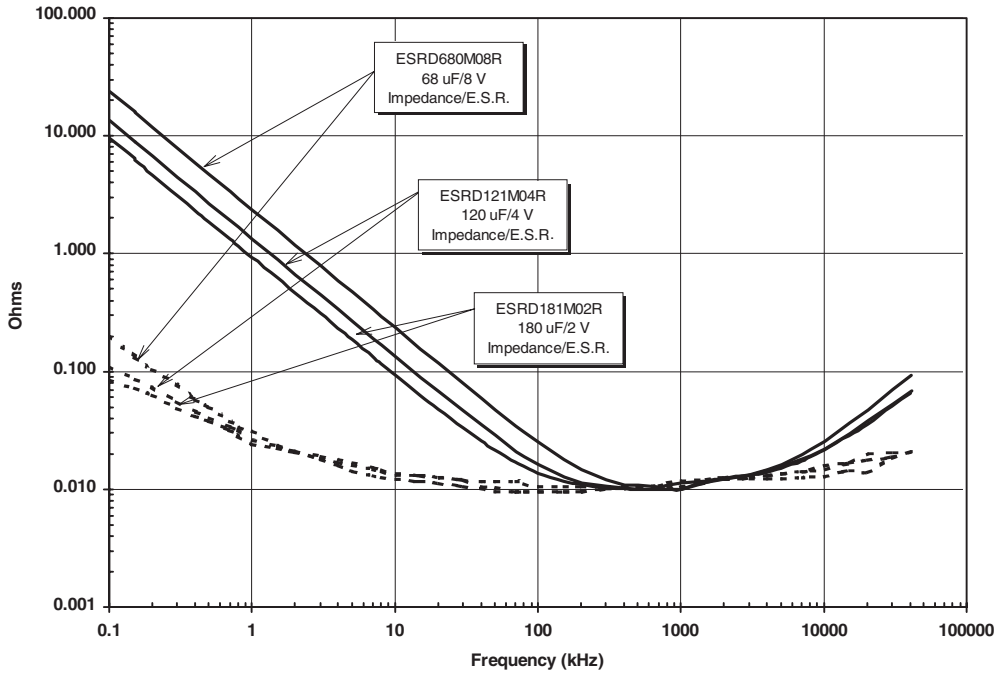
Typical Temperature Characteristics



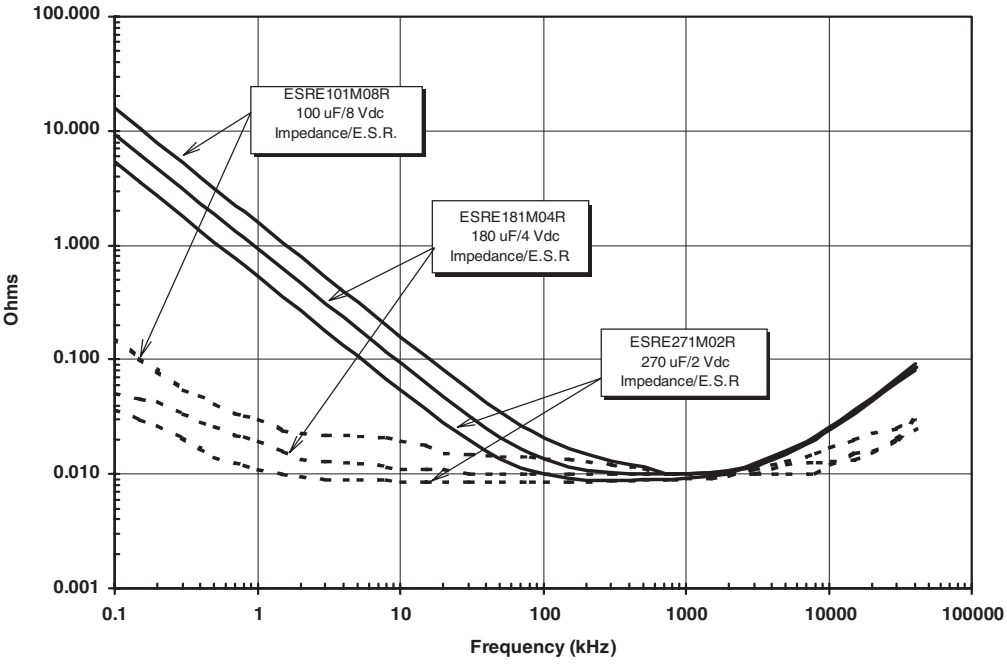


Typical Impedance and Equivalent Series Resistance

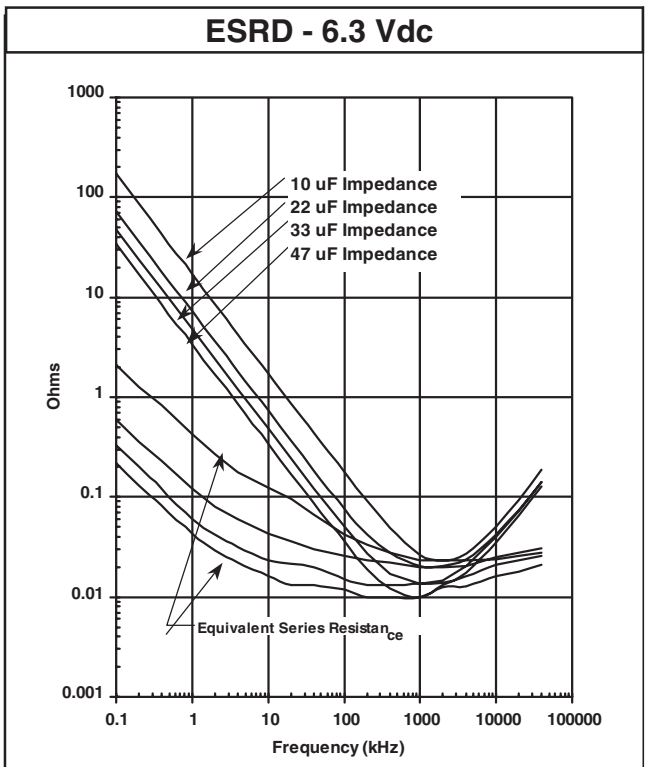
ESRD (3.1 mm Ht.)

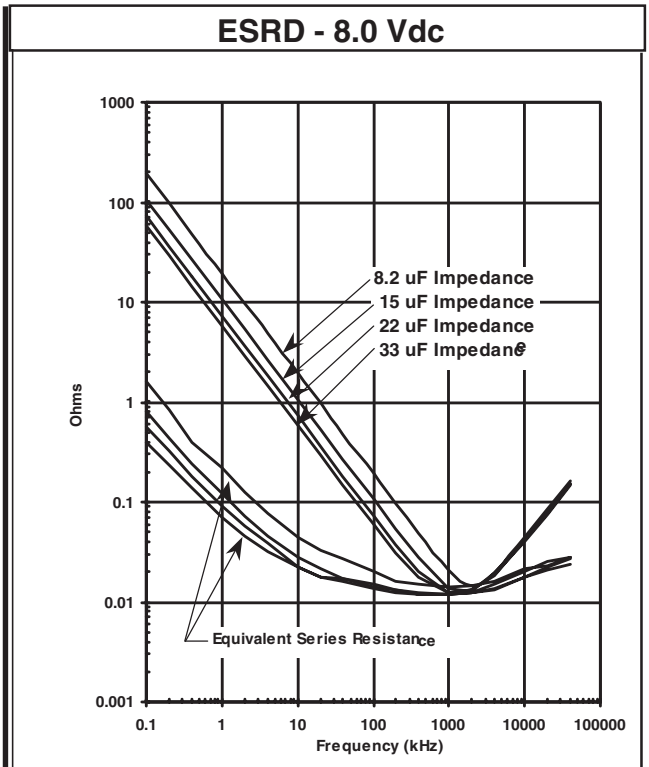


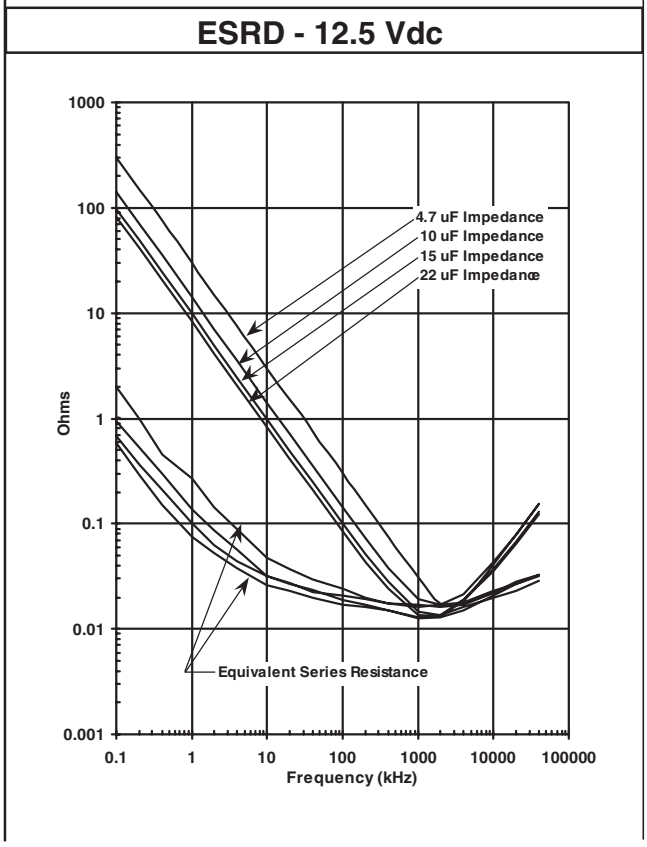
ESRE

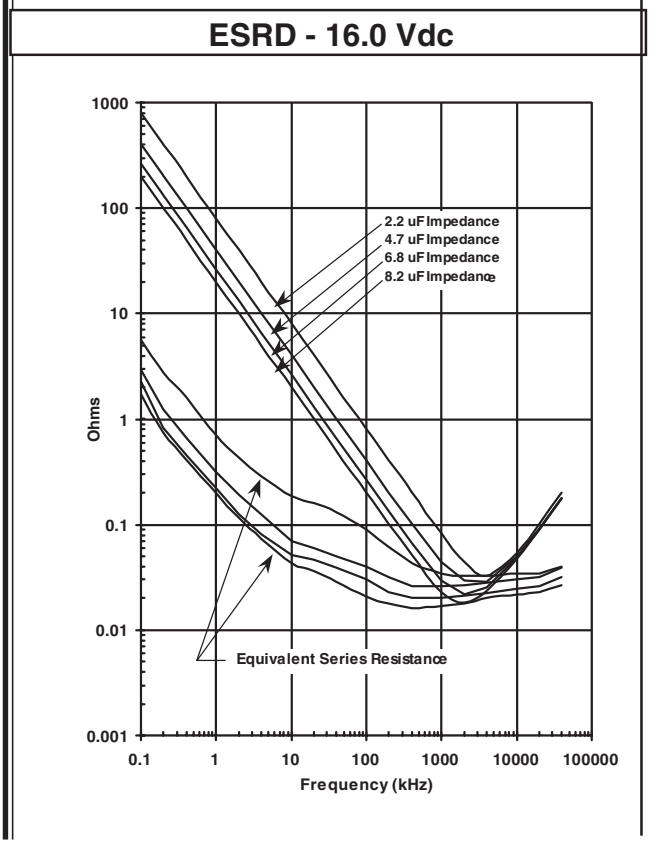


Typical Impedance and Equivalent Series Resistance



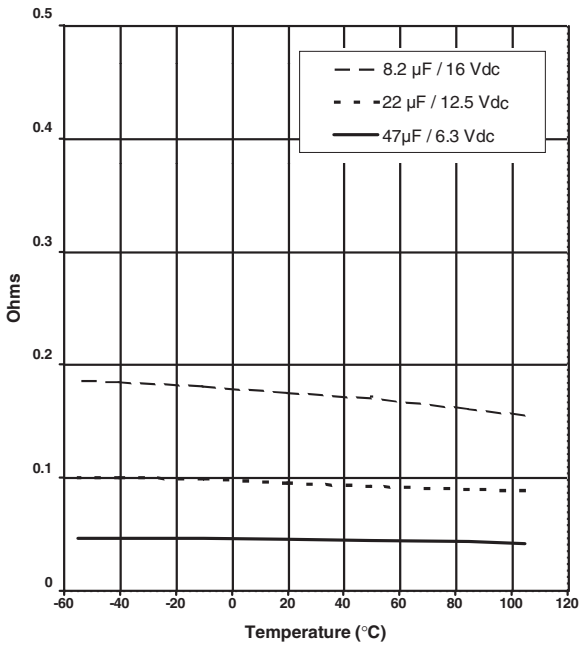




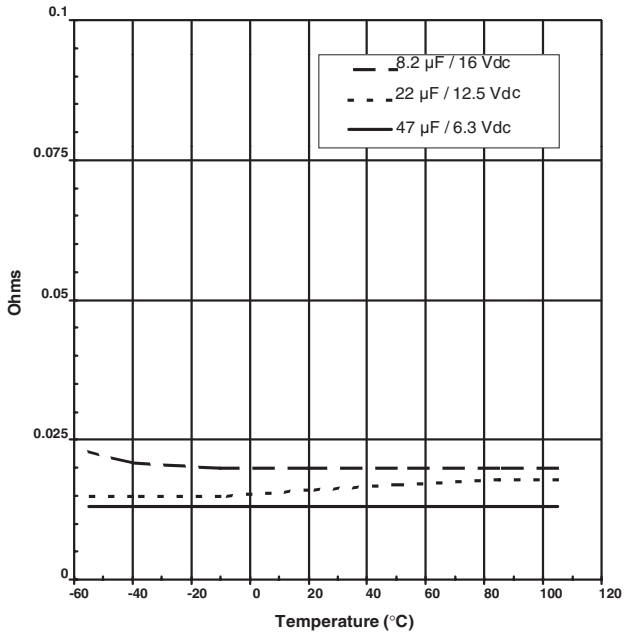


Typical Temperatrue Characteristics

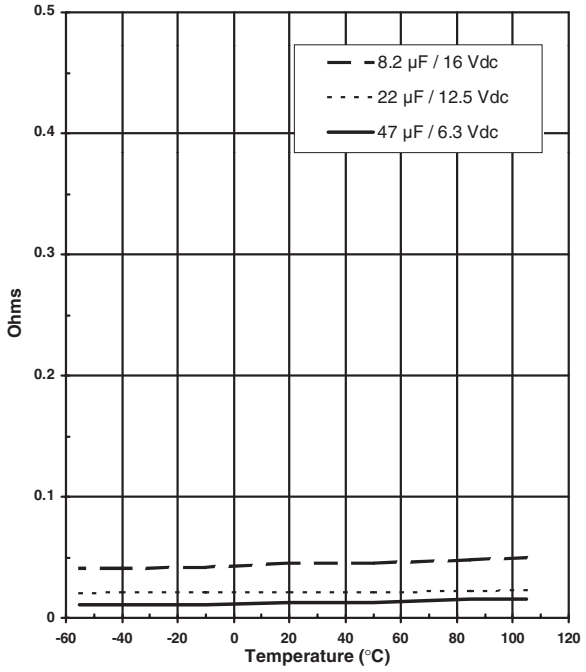
Impedance at 100 kHz



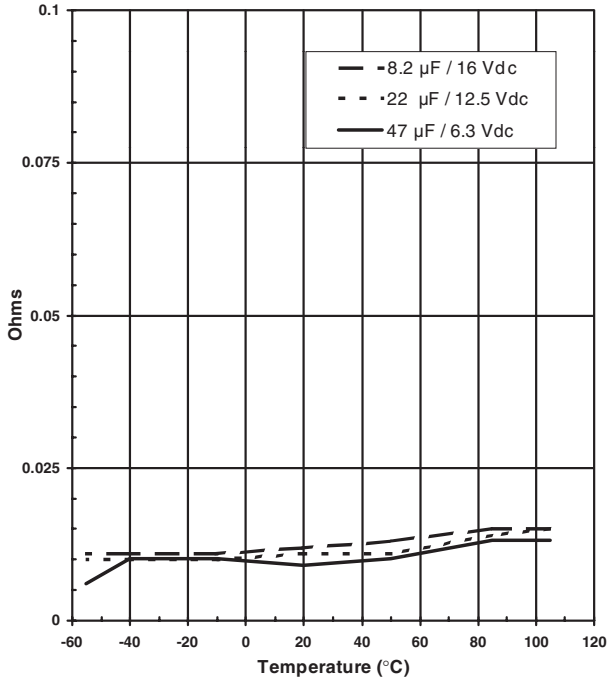
E.S.R. at 100 kHz



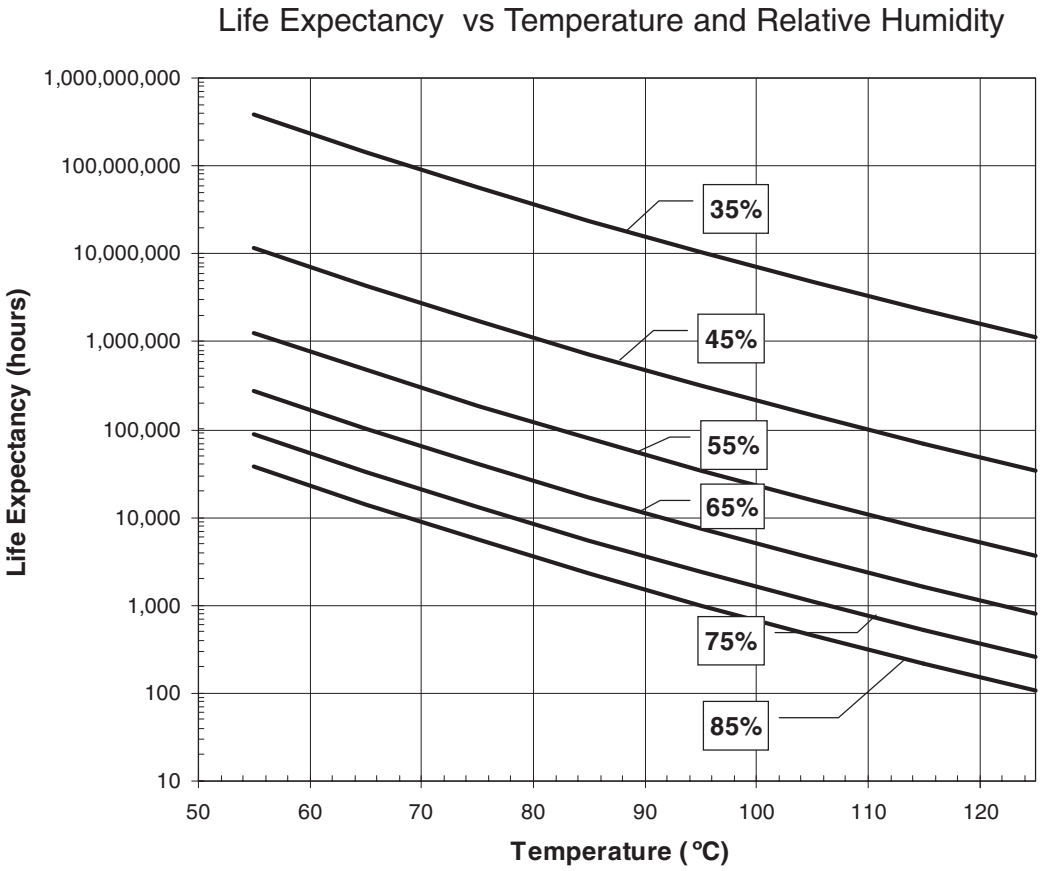
Impedance at 400 kHz



E.S.R. at 400 kHz

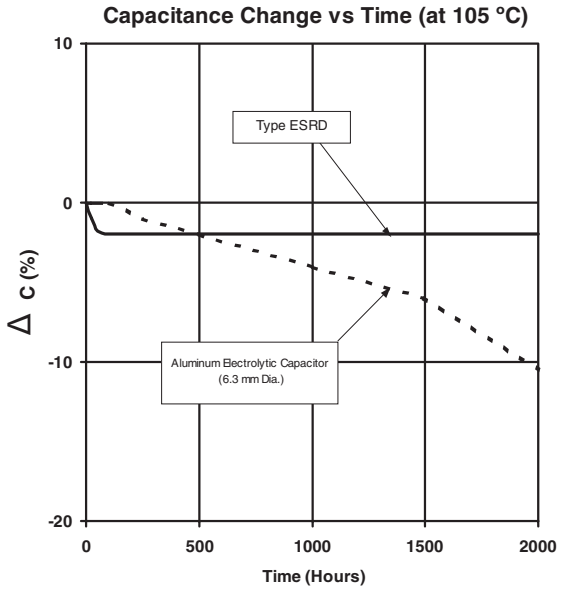


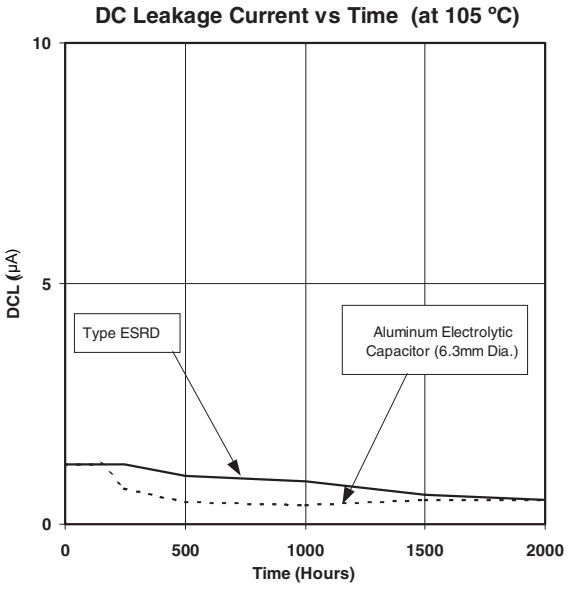
Life Expectancy



Note: Failure limit is 100% impedance increase at 400 kHz.

Endurance Test Data





Application Notes

Rated Voltage

This is the maximum voltage that the capacitor has been designed to withstand continuously at rated temperature. Solid polymer aluminum capacitors are quite rugged and may be operated continuously at rated voltage. Voltage derating does not significantly increase the life expectancy of the capacitor. At voltage levels equal to or less than rated voltage,the capacitor will not short circuit (even at end of life). In fact it can self heal. A polymer aluminum capacitor can be operated over a lifetime at full rated voltage without worry of short circuiting. However, if subjected to sufficient over voltage or reverse voltage, a SPA capacitor can fail short circuit.

Ripple Current/Ripple Voltage

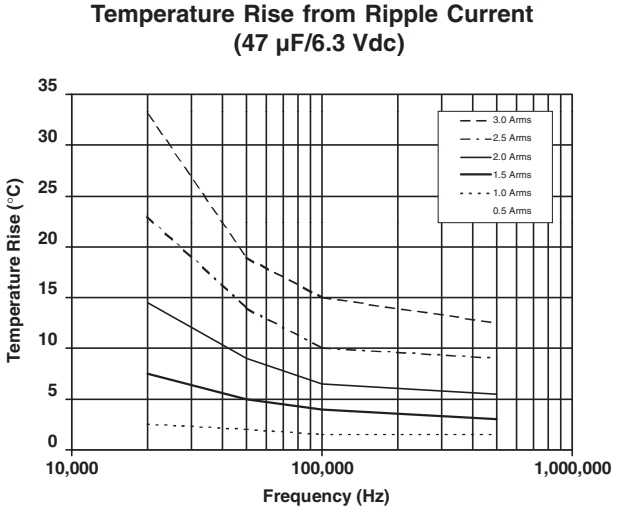
AC voltage as part of the capacitorís DC bias voltage will cause current to flow through the capacitor. This ripple current flows through the capacitor's equivalent series resistance generating heat. The heat increases the capacitor ís internal temperature. Exceeding the specific maximum ripple current will overheat the capacitor. The maximum ripple current ratings are given in the ratings tables. Peaks of the AC ripple voltage should not exceed the rated voltage or cause voltage reversal temperature. Exceeding the specified maximum ripple current will overheat and damage the capacitor. The maximum ripple current ratings are given in the ratings tables.

Shelf Life

When stored at room temperature, in low humidity, and out of direct sunlight, SPA capacitors have a storage life of 42 months. Storage at high humidity over long periods of time can cause the DC leakage current to increase. However, the application of rated voltage will reduce the DC leakage current to normal limits.

Reverse Voltage

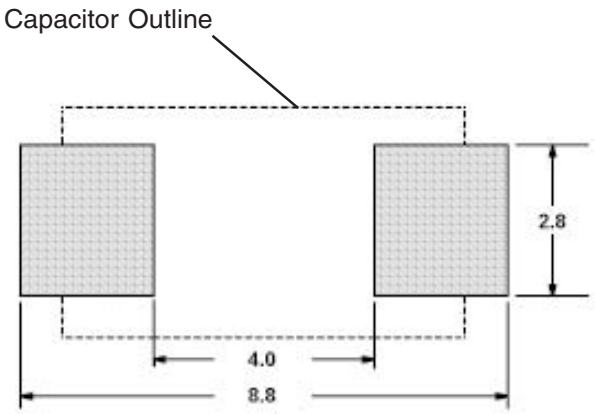
SPA capacitors are polarized and are not intended to be used with reversed voltage. They can withstand reverse voltage pulses or transients up to 20% of the rated voltage, and they are capable of operating with up to 10% of the rated voltage when reverse voltage is applied continuously.



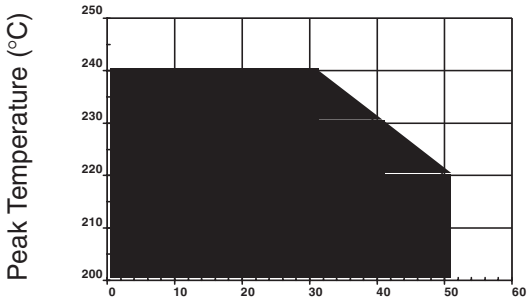
Ripple Current Frequency Multipliers

Frequency (kHz)	10	20	50	100	250	500	1000
Frequency Multipliers for Sine Wave Current +20 to +105 ºC	0.6	0.7	0.8	1.0	1.1	1.2	1.3

Recommended Circuit Board Mounting Pads



Dimensions in (mm)



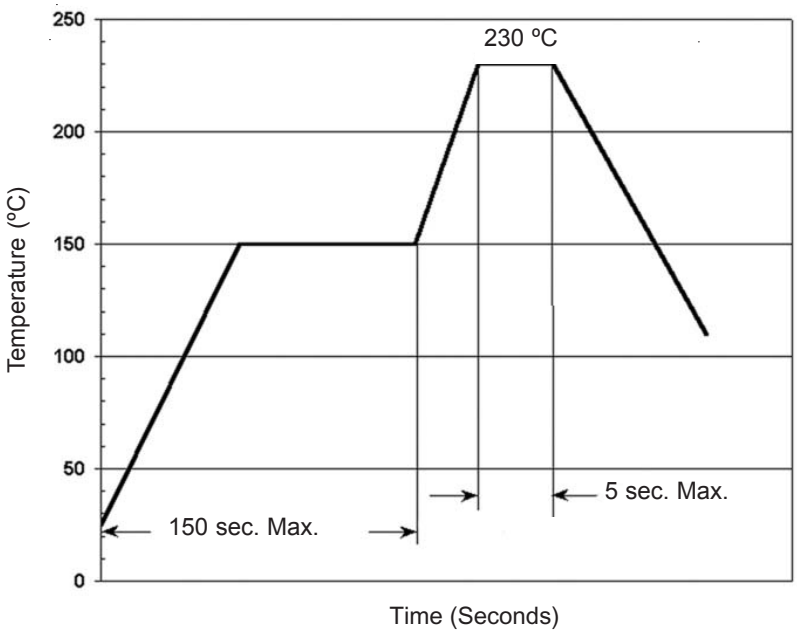
Time at 200 °C or above (seconds)

Reclamation

The resin case of a capacitor can be damaged by the heat stress of soldering if it has absorbed excessive moisture. Capacitors suspected of having been exposed to high humidity can be reclaimed by placing them in an oven at 50 °C for 100 hours.

Reflow Soldering

The following graph gives the maximum recommended capacitor surface temperature during reflow soldering.



See chart, at top right, forTime at 200 °C or above

Heat Stress while Soldering

DC leakage current can increase after soldering, but it will return to the initial level after applying voltage. When using a soldering iron to mount the capacitor, the iron should have a maximum temperature of 350°C and soldering should not exceed 10 seconds.

Cleaning

The capacitors can withstand for 5 minutes at 60 °C the following cleaning solvents by dipping or ultrasonic methods:

Pine Alpha ST-100S
Sunelec B-12
DK Be-Clear CW-5790
Aqua Cleaner 210SEP
Cold Cleaner P3-375
Telpen Cleaner EC-7R
Clean-Thru 750H, 750L, and 710M
Techno-Cleaner 219
Techno-Care FRW-1, FRW-17, & FRV-1

After cleaning, wash the circuit board with water for about 3 minutes, and dry at 100 °C for 20 minutes.

Up to 50 Years Life

SPA SMT capacitors are polarized, aluminum capacitors which use a highly conductive solid polymer as the electrolyte. They have reliability advantages over both aluminum and solid tantalum electrolytic capacitors. Unlike aluminum capacitors,there is no liquid electrolyte that can evaporate and cause a failure. Unlike solid tantalum which can fail short and burn, SPA capacitors gradually become open circuits after 25 to 50 years operation.

Life expectancy curves show 200,000 hours expected life at full rated voltage and normal ambient conditions.

Ultra Low E.S.R. and High Rippled Current Capability

The equivalent series resistance (e.s.r.) of solid polymer aluminum capacitors is much lower than the e.s.r. of solid tantalum capacitors. This results in a much higher ripple current handling capability. The e.s.r. is even lower than the new tantalum polymer hybrid capacitors. SPA' s ultra-low resistance magic is in the solid conductive polymer.

The series resistance of electrolytic capacitors is largely determined by the resistivity of the electrolyte. Because the resistivity of SPA's polymer electrolyte is several orders of magnitude less than that of other electrolytes, the equivalent series resistance is almost zero.

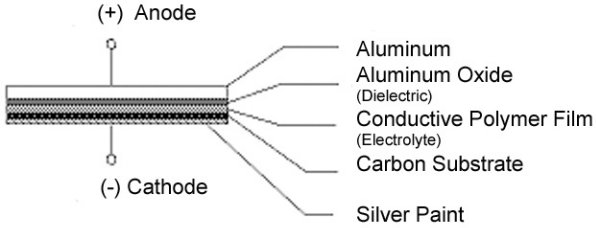
Construction

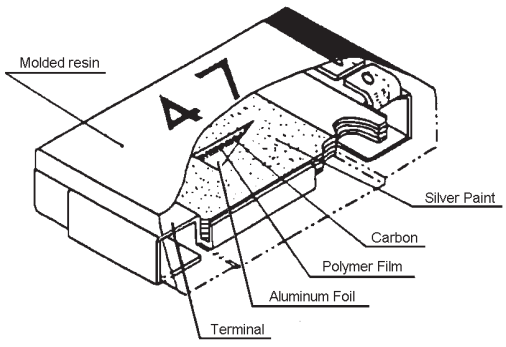
Construction is a unique combination of the elements of aluminum electrolytic and solid tantalum capacitors.

Like conventional aluminum electrolytic capacitors, the anode in SPA capacitors is an aluminum plate on which an aluminum oxide layer has been built up by an electrolysis process. The aluminum oxide serves as the dielectric in both SPA and conventional aluminum electrolytics.

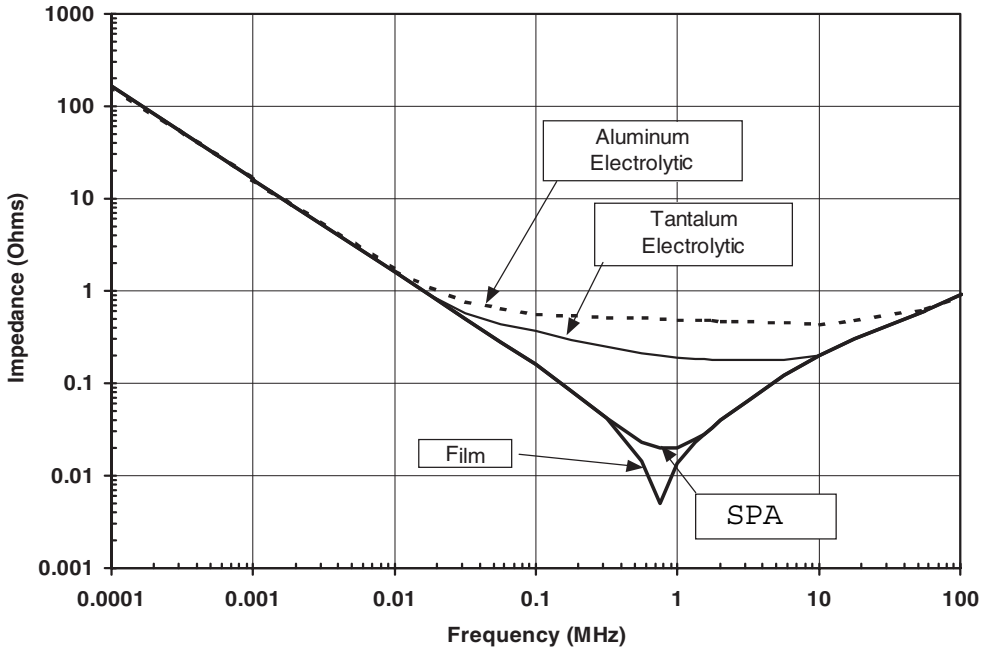
The dielectric in solid tantalum capacitors is tantalum pentoxide which is built upon a tantalum pellet anode. A highly conductive polymer electrolyte film is deposited over the aluminum oxide dielectric in SPA capacitors. Carbon and silver paint are used to finish the capacitor's cathode. This is similar to what is used in solid tantalum capacitors, where manganese dioxide is used as the electrolyte.

The capacitor element is encased in a molded resin that is capable of meeting the UL-94,V0 flammability rating. The terminals are solder coated copper clad steel.

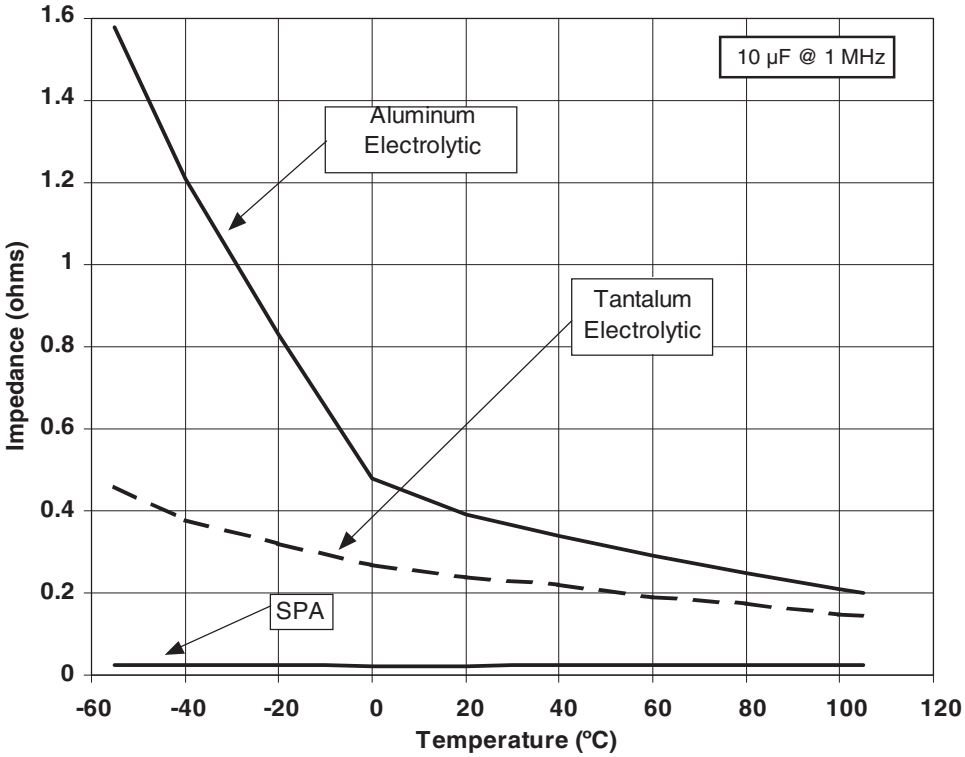




SPA Compared to Other Electrolytics

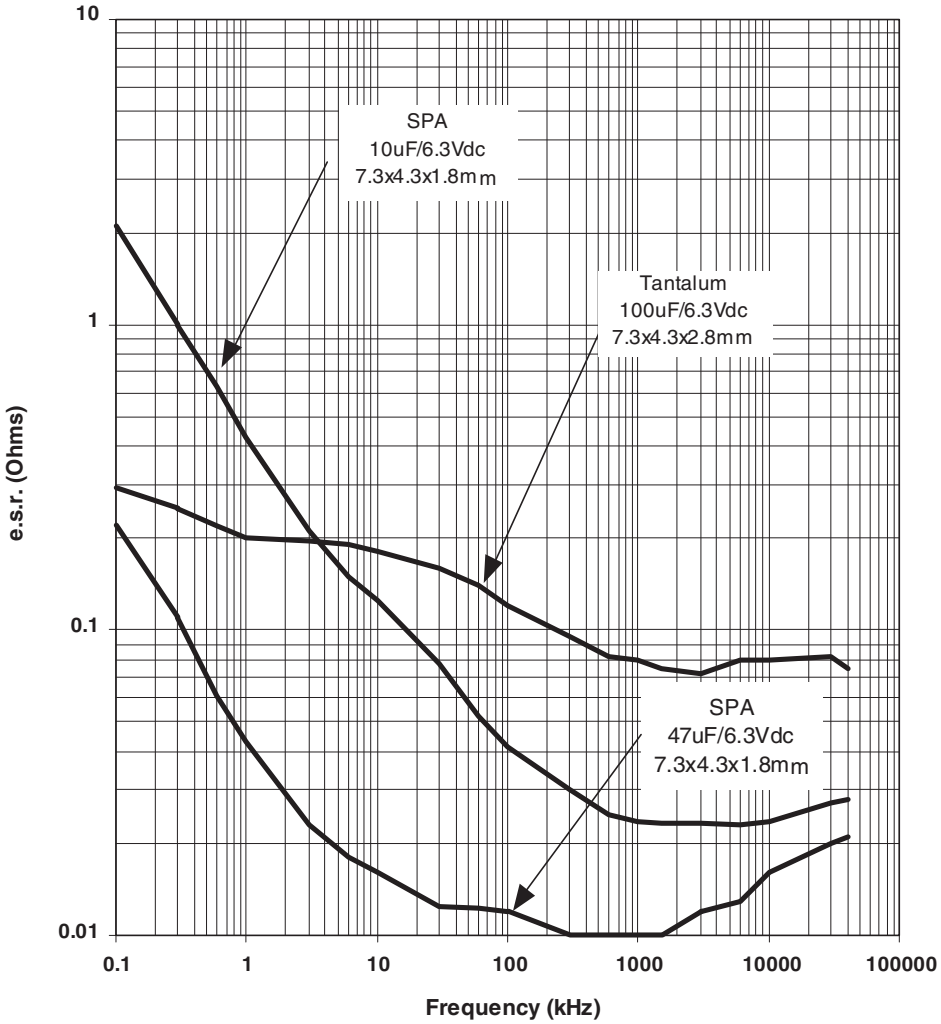


SPA capacitors have lower impedance at high frequencies than the same values of wet electrolyte aluminum capacitors and solid tantalum capacitors.



SPA capacitors have stable impedance over the entire temperature range.

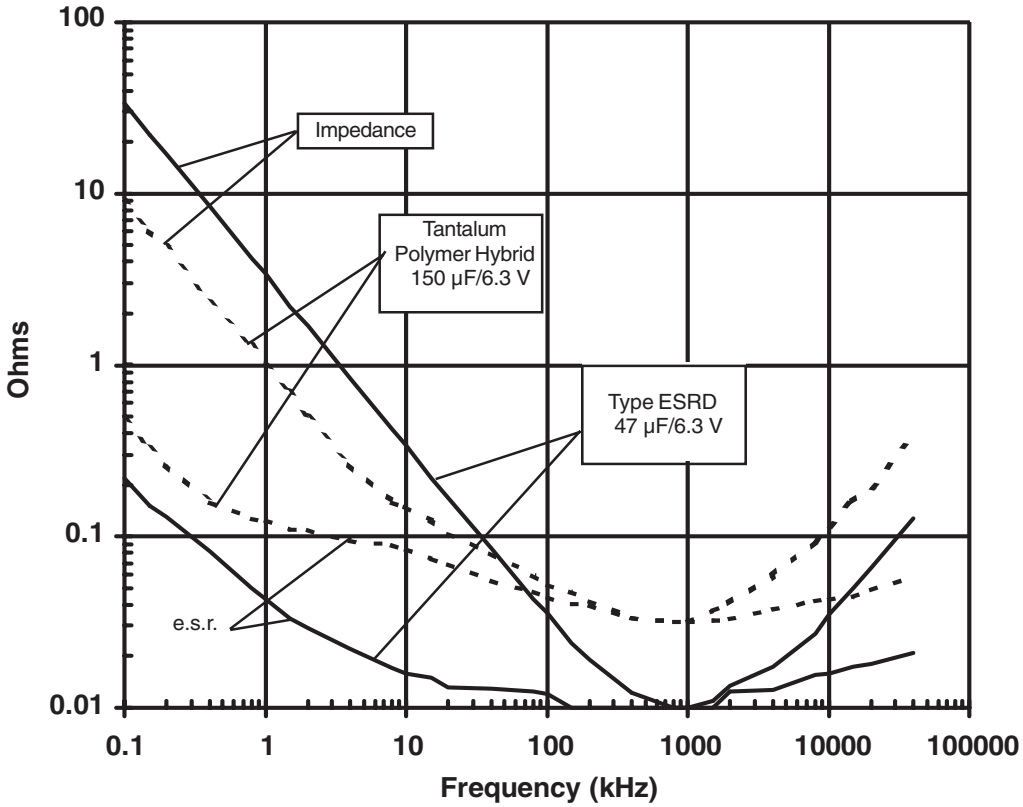
SPA vs Solid Tantalum



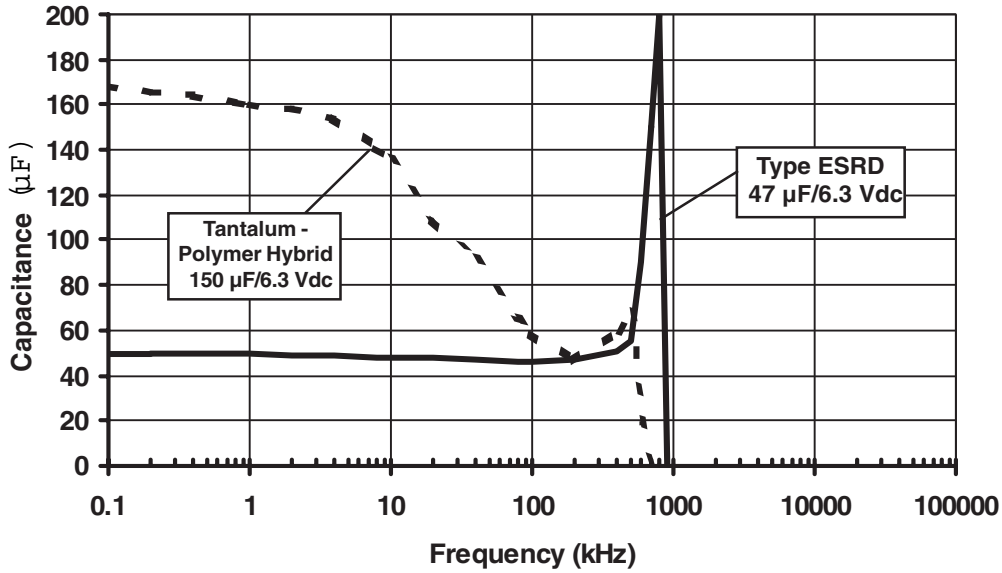
Frequency	100 µF Tantalum Capacitor		47 µF Solid Polymer Aluminum Electrolytic Capacitor	
	Equivalent Series Resistance (Ω)	Impedance Magnitude IZI (Ω)	Equivalent Series Resistance (Ω)	Impedance Magnitude IZI (Ω)
100.0 kHz	0.12	0.12	0.012	0.035
1.0 MHz	0.08	0.08	0.010	0.010
100.0 Mhz	0.08	0.19	0.016	0.035

At 1 MHz the Solid Polymer Aluminum capacitor will provide almost 8 times more ripple and noise attenuation (.08/.01) as compared to the tantalum capacitor.

SPA vs Solid Tantalum-Polymer Hybrid



Type ESRD's impedance and equivalent series resistance are lower at high frequencies than that of tantalum-polymer hybrid type capacitors.



Note the capacitance roll off of the tantalum-polymer capacitor at high frequencies. The tantalum-polymer capacitor loses approximately 2/3 of its capacitance at 100 kHz.

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