



**THE DATASHEET OF
SPA560M06B**



Solid Polymer Aluminum SMT Capacitors



Solid Polymer Aluminum capacitors combine the high capacitance capability of an electrolytic component with the high frequency performance of film capacitors. When the need for low impedance at high frequency is critical for your design, one ESRD chip is capable of replacing several liquid electrolyte aluminum or tantalum capacitors connected in parallel.

Highlights

- Ultra-Low ESR - 5 mΩ to 9 mΩ @ 100 kHz
- High Ripple Current - up to 4.0 Arms at 100 kHz
- Long Life - No dry out failure related mechanism
- Stable Impedance and ESR vs. Temperature
- Great for bulk storage and ripple filtering
- Ignition free

Specifications

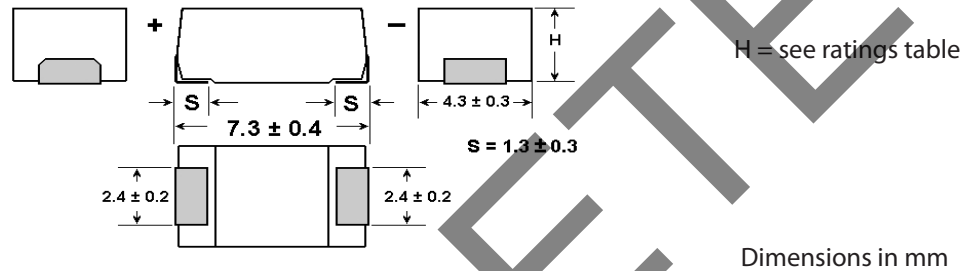
| | |
|-----------------------------|--|
| Capacitance Range | 2.2 μF to 470 μF |
| Capacitance Tolerance | ±20% at 120 Hz and 20 °C |
| DF | 10% max at 120 Hz and 20 °C ESRD (1.8 mm height): 6% max. |
| Surge Test | Performed at 20°C with a 1000 ohm series resistor. Apply 1.25 x the rated voltage for 1000 cycles of 30 sec. on and 5 min. and 30 sec. off. After surge voltage testing, no abnormal change in appearance shall occur because of the test, and the capacitance shall be within ±10% of the initial measured value, and the DCL and DF shall meet the initial specifications. |
| Operating Temperature Range | -55 °C to +105 °C at 100% of the rated voltage (ESRH: -55°C to +125°C at 75% of the rated voltage) |
| DC Leakage Current (DCL) | After a two minute application of the rated working voltage at +20 °C: 2 V - 4 V: $I \leq 0.06 \text{ CV}$, 6.3 V - 16 V: $I \leq 0.04 \text{ CV}$ or 3μA (whichever is greater) SPSX and SPCX: $I \leq 0.1 \text{ CV}$ |
| Moisture Resistance | Store capacitor for 500 hours at +60 °C and 90% to 95% RH without load. After the test, the capacitors will meet the following limits: Δ C = +70%/-20% of the initial measured value (2.0 Vdc, 2.5 Vdc), +60%/-20% of the initial measured value (4.0 Vdc), +50%/-20% of the initial measured value (6.3 Vdc), +40%/-20% of the initial measured value (all other voltages) DF ≤ two times the initial specified value DCL ≤ the initial specified value |
| Life Test | Apply rated DC working voltage at 105 °C for 1000 hours, and then stabilize them to +20 °C. After the test, the capacitors will meet the following limits: Δ C = ±10% of the initial measured value DF ≤ the initial specified value DCL ≤ the initial specified value |
| Shelf Life Test | Shelf life is typically 5 to 10 years. Accelerated test: 500 hours at 105 °C, and then stabilize them to +20 °C. After the test, the capacitors will meet the following limits: Δ C = ±10% of the initial measured value DF ≤ the initial specified value DCL ≤ the initial specified value |
| Vibration | Capacitors are soldered to a board and then subjected to a vibration of 1.5 mm amplitude that is varied from 10 Hz to 2000 Hz to 10 Hz in 20 min. cycles. The test duration is 2 hours for each of the three right angle directions (total 6 hours). Capacitance is monitored during the last cycle of the test for stability. No abnormal change in appearance shall occur because of the test. |

Solid Polymer Aluminum SMT Capacitors

Part Numbering System

| | | | | | |
|-------------|--------------------|------------------|----------------|---------------|-----------------------|
| ESRD | 4R7 | M | 16 | | R |
| | | | | | |
| Type | Capacitance | Tolerance | Voltage | | Packaging Code |
| | 4R7 = 4.7 μ F | M = \pm 20% | 02 = 2.0 Vdc | 08 = 8.0 Vdc | R = Tape and Reel |
| | 220 = 22 μ F | | 0E = 2.5 Vdc | 12 = 12.5 Vdc | |
| | 101 = 100 μ F | | 04 = 4.0 Vdc | 16 = 16.0 Vdc | |
| | | | 06 = 6.3 Vdc | | |

Dimensions



Ratings

| Capacitance (μ F) | Catalog Part Number (Tape & Reel) | Rated Voltage WVDC | Maximum E.S.R. 100 kHz/20 °C (Ω) | Maximum Ripple Current 100 kHz/105 °C Arms | Case Height (mm) | Peak Soldering Temperature (°C) | Qty/ Reel |
|---------------------------|---|--------------------------|--|---|------------------------|--|--------------|
| 100 | ESRD101M02R | 2.0 | 0.018 | 2.5 | 1.8 \pm 0.1 | 240 | 3500 |
| 120 | ESRD121M02XR | 2.0 | 0.015 | 2.7 | 1.8 \pm 0.1 | 240 | 3500 |
| 120 | SPA121M02R | 2.0 | 0.009 | 3.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 150 | SPA151M02R | 2.0 | 0.009 | 3.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 180 | ESRD181M02R | 2.0 | 0.015 | 3.0 | 2.8 \pm 0.2 | 240 | 2000 |
| 180 | ESRH181M02R | 2.0 | 0.015 | 2.5 | 2.8 \pm 0.2 | 240 | 2000 |
| 180 | SPA181M02R | 2.0 | 0.009 | 3.0 | 1.9 \pm 0.2 | 240 | 3500 |
| 180 | SPSX181M02R | 2.0 | 0.009 | 3.0 | 1.9 \pm 0.2 | 260 | 3500 |
| 220 | ESRD221M02R | 2.0 | 0.015 | 3.0 | 2.8 \pm 0.2 | 240 | 2000 |
| 220 | SPCX221M02R | 2.0 | 0.015 | 2.7 | 1.9 \pm 0.2 | 260 | 3500 |
| 220 | SPSX221M02R | 2.0 | 0.009 | 3.0 | 1.9 \pm 0.2 | 260 | 3500 |
| 270 | ESRD271M02XR | 2.0 | 0.012 | 3.3 | 2.8 \pm 0.2 | 240 | 2000 |
| 270 | ESRH271M02R | 2.0 | 0.012 | 3.0 | 4.1 \pm 0.2 | 240 | 2000 |
| 270 | ESRE271M02R | 2.0 | 0.015 | 3.0 | 4.1 \pm 0.3 | 240 | 2000 |
| 270 | SPSX271M02R | 2.0 | 0.009 | 3.0 | 1.9 \pm 0.2 | 260 | 3500 |
| 330 | ESRE331M02R | 2.0 | 0.015 | 3.0 | 4.1 \pm 0.3 | 240 | 2000 |
| 330 | SPCX331M02R | 2.0 | 0.015 | 2.7 | 1.9 \pm 0.2 | 260 | 3500 |
| 330 | SPSX331M02R | 2.0 | 0.009 | 3.0 | 1.9 \pm 0.2 | 260 | 3500 |
| 390 | ESRE391M02XR | 2.0 | 0.010 | 3.5 | 4.1 \pm 0.3 | 240 | 2000 |
| 390 | SPCX391M02R | 2.0 | 0.015 | 2.7 | 1.9 \pm 0.2 | 260 | 3500 |
| 390 | SPSX391M02R | 2.0 | 0.009 | 3.0 | 1.9 \pm 0.2 | 260 | 3500 |
| 470 | SPA471M02R | 2.0 | 0.005 | 4.0 | 4.2 \pm 0.1 | 240 | 2000 |
| 470 | SPCX471M02R | 2.0 | 0.015 | 2.7 | 1.9 \pm 0.2 | 260 | 3500 |
| 470 | SPSX471M02R | 2.0 | 0.009 | 3.0 | 1.9 \pm 0.2 | 260 | 3500 |

Solid Polymer Aluminum SMT Capacitors

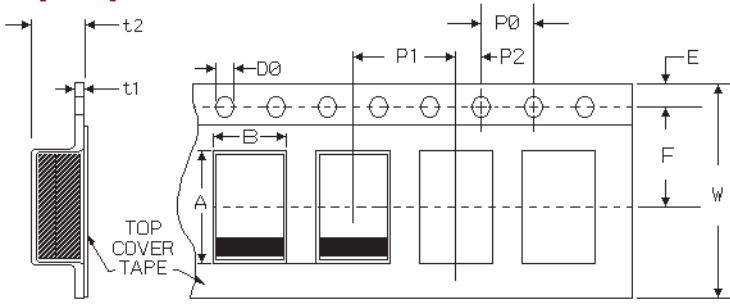
| Capacitance (μ F) | Catalog Part Number (Tape & Reel) | Rated Voltage WVDC | Maximum | Maximum | Case Height (mm) | Peak | Qty/ Reel |
|---------------------------|---|--------------------------|---|--|------------------------|----------------------------------|--------------|
| | | | E.S.R. 100 kHz/20 °C (Ω) | Ripple Current 100 kHz/105 °C Arms | | Soldering Temperature (°C) | |
| 100 | ESRD101M0EXR | 2.5 | 0.015 | 2.7 | 1.8 ±0.1 | 240 | 3500 |
| 100 | SPA101M0ER | 2.5 | 0.009 | 3.0 | 1.8 ±0.1 | 240 | 3500 |
| 120 | SPA121M0ER | 2.5 | 0.009 | 3.0 | 1.8 ±0.1 | 240 | 3500 |
| 150 | ESRD151M0ER | 2.5 | 0.015 | 3.0 | 2.8 ±0.2 | 240 | 2000 |
| 150 | ESRH151M0ER | 2.5 | 0.015 | 2.5 | 2.8 ±0.2 | 240 | 2000 |
| 150 | SPA151M0ER | 2.5 | 0.009 | 3.0 | 1.9 ±0.2 | 240 | 3500 |
| 150 | SPSX151M0ER | 2.5 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 180 | ESRD181M0ER | 2.5 | 0.015 | 3.0 | 2.8 ±0.2 | 240 | 2000 |
| 180 | SPSX181M0ER | 2.5 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 220 | ESRD221M0EXR | 2.5 | 0.012 | 3.3 | 2.8 ±0.2 | 240 | 2000 |
| 220 | ESRH221M0ER | 2.5 | 0.012 | 3.0 | 4.1 ±0.2 | 240 | 2000 |
| 220 | ESRE221M0ER | 2.5 | 0.015 | 3.0 | 4.1 ±0.3 | 240 | 2000 |
| 220 | SPCX221M0ER | 2.5 | 0.015 | 2.7 | 1.9 ±0.2 | 260 | 3500 |
| 220 | SPSX221M0ER | 2.5 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 270 | ESRE271M0ER | 2.5 | 0.015 | 3.0 | 4.1 ±0.3 | 240 | 2000 |
| 330 | ESRE331M0EXR | 2.5 | 0.01 | 3.5 | 4.1 ±0.3 | 240 | 2000 |
| 330 | SPA331M0ER | 2.5 | 0.005 | 4.0 | 4.2 ±0.1 | 240 | 2000 |
| 330 | SPCX331M0ER | 2.5 | 0.015 | 2.7 | 1.9 ±0.2 | 260 | 3500 |
| 330 | SPSX331M0ER | 2.5 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 390 | SPA391M0ER | 2.5 | 0.005 | 4.0 | 4.2 ±0.1 | 240 | 2000 |
| 390 | SPCX391M0ER | 2.5 | 0.015 | 2.7 | 1.9 ±0.2 | 260 | 3500 |
| 390 | SPSX391M0ER | 2.5 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 56 | ESRD560M04R | 4.0 | 0.018 | 2.5 | 1.8 ±0.1 | 240 | 3500 |
| 82 | ESRD820M04XR | 4.0 | 0.015 | 2.7 | 1.8 ±0.1 | 240 | 3500 |
| 82 | SPA820M04R | 4.0 | 0.009 | 3.0 | 1.8 ±0.1 | 240 | 3500 |
| 82 | SPSX820M04R | 4.0 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 100 | SPA101M04R | 4.0 | 0.009 | 3.0 | 1.9 ±0.2 | 240 | 3500 |
| 100 | SPSX101M04R | 4.0 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 120 | ESRD121M04R | 4.0 | 0.015 | 3.0 | 2.8 ±0.2 | 240 | 2000 |
| 120 | ESRH121M04R | 4.0 | 0.015 | 2.5 | 2.8 ±0.2 | 240 | 2000 |
| 150 | ESRD151M04XR | 4.0 | 0.012 | 3.3 | 2.8 ±0.2 | 240 | 2000 |
| 150 | SPCX151M04R | 4.0 | 0.015 | 2.7 | 1.9 ±0.2 | 260 | 3500 |
| 150 | SPSX151M04R | 4.0 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 180 | ESRH181M04R | 4.0 | 0.012 | 3.0 | 4.1 ±0.2 | 240 | 2000 |
| 180 | ESRE181M04R | 4.0 | 0.015 | 3.0 | 4.1 ±0.3 | 240 | 2000 |
| 180 | SPCX181M04R | 4.0 | 0.015 | 2.7 | 1.9 ±0.2 | 260 | 3500 |
| 180 | SPSX181M04R | 4.0 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 220 | ESRE221M04XR | 4.0 | 0.015 | 3.5 | 4.1 ±0.3 | 240 | 2000 |
| 220 | SPA221M04R | 4.0 | 0.005 | 4.0 | 4.2 ±0.1 | 240 | 2000 |
| 220 | SPCX221M04R | 4.0 | 0.015 | 2.7 | 1.9 ±0.2 | 260 | 3500 |
| 220 | SPSX221M04R | 4.0 | 0.009 | 3.0 | 1.9 ±0.2 | 260 | 3500 |
| 10 | ESRD100M06R | 6.3 | 0.055 | 1.4 | 1.8 ±0.1 | 240 | 3500 |

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| Capacitance (μ F) | Catalog Part Number (Tape & Reel) | Rated Voltage WVDC | Maximum | Maximum | Case Height (mm) | Peak | Qty/ Reel |
|---------------------------|---|--------------------------|---|--|------------------------|----------------------------------|--------------|
| | | | E.S.R. 100 kHz/20 °C (Ω) | Ripple Current 100 kHz/105 °C Arms | | Soldering Temperature (°C) | |
| 22 | ESRD220M06R | 6.3 | 0.04 | 1.6 | 1.8 \pm 0.1 | 240 | 3500 |
| 33 | ESRD330M06R | 6.3 | 0.028 | 2.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 47 | ESRD470M06R | 6.3 | 0.018 | 2.5 | 1.8 \pm 0.1 | 240 | 3500 |
| 56 | SPA560M06R | 6.3 | 0.009 | 3.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 68 | ESRD680M06XR | 6.3 | 0.015 | 2.7 | 1.8 \pm 0.1 | 240 | 3500 |
| 68 | SPA680M06R | 6.3 | 0.009 | 3.0 | 1.9 \pm 0.2 | 240 | 3500 |
| 100 | ESRD101M06R | 6.3 | 0.015 | 3.0 | 2.8 \pm 0.2 | 240 | 2000 |
| 100 | ESRH101M06R | 6.3 | 0.015 | 2.5 | 2.8 \pm 0.2 | 240 | 2000 |
| 100 | SPCX101M06R | 6.3 | 0.015 | 2.7 | 1.9 \pm 0.2 | 260 | 3500 |
| 120 | ESRD121M06XR | 6.3 | 0.012 | 3.3 | 2.8 \pm 0.2 | 240 | 2000 |
| 120 | SPCX121M06R | 6.3 | 0.015 | 2.7 | 1.9 \pm 0.2 | 260 | 3500 |
| 150 | ESRH151M06R | 6.3 | 0.012 | 3.0 | 4.1 \pm 0.2 | 240 | 2000 |
| 150 | ESRE151M06R | 6.3 | 0.015 | 3.0 | 4.1 \pm 0.3 | 240 | 2000 |
| 150 | SPCX151M06R | 6.3 | 0.015 | 2.7 | 1.9 \pm 0.2 | 260 | 3500 |
| 150 | SPSX151M06R | 6.3 | 0.009 | 3.0 | 1.9 \pm 0.2 | 260 | 3500 |
| 180 | ESRE181M06XR | 6.3 | 0.015 | 3.5 | 4.1 \pm 0.3 | 240 | 2000 |
| 180 | SPA181M06R | 6.3 | 0.005 | 4.0 | 4.2 \pm 0.1 | 240 | 2000 |
| 8.2 | ESRD8R2M08R | 8.0 | 0.055 | 1.4 | 1.8 \pm 0.1 | 240 | 3500 |
| 15 | ESRD150M08R | 8.0 | 0.04 | 1.6 | 1.8 \pm 0.1 | 240 | 3500 |
| 22 | ESRD220M08R | 8.0 | 0.028 | 2.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 33 | ESRD330M08R | 8.0 | 0.018 | 2.5 | 1.8 \pm 0.1 | 240 | 3500 |
| 68 | ESRD680M08R | 8.0 | 0.015 | 3.0 | 2.8 \pm 0.2 | 240 | 2000 |
| 68 | ESRH680M08R | 8.0 | 0.015 | 2.5 | 2.8 \pm 0.2 | 240 | 2000 |
| 100 | ESRH101M08R | 8.0 | 0.012 | 3.0 | 4.1 \pm 0.2 | 240 | 2000 |
| 100 | ESRE101M08R | 8.0 | 0.015 | 3.0 | 4.1 \pm 0.3 | 240 | 2000 |
| 4.7 | ESRD4R7M12R | 12.5 | 0.08 | 1.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 10 | ESRD100M12R | 12.5 | 0.06 | 1.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 15 | ESRD150M12R | 12.5 | 0.05 | 1.3 | 1.8 \pm 0.1 | 240 | 3500 |
| 22 | ESRD220M12R | 12.5 | 0.03 | 1.6 | 1.8 \pm 0.1 | 240 | 3500 |
| 2.2 | ESRD2R2M16R | 16.0 | 0.11 | 1.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 4.7 | ESRD4R7M16R | 16.0 | 0.08 | 1.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 6.8 | ESRD6R8M16R | 16.0 | 0.07 | 1.0 | 1.8 \pm 0.1 | 240 | 3500 |
| 8.2 | ESRD8R2M16R | 16.0 | 0.045 | 1.3 | 1.8 \pm 0.1 | 240 | 3500 |

Solid Polymer Aluminum SMT Capacitors

Tape Specifications

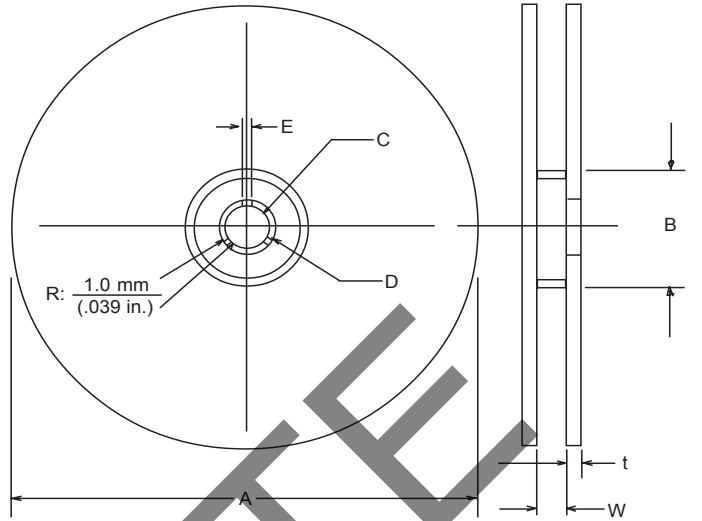


| | | | | |
|---|-------------|-------------|-------------|------------|
| Solid Polymer Aluminum Type | ESRD | ESRE | ESRH | SPA |
| $t_2 = H + 0.3 \text{ mm} \pm 0.2 \text{ mm}$ | | | | |

| W | E | F | D ϕ | P ϕ | P ₁ | P ₂ | A | B | t ₁ | |
|-----------|-----|-----|-----------|----------|----------------|----------------|-----|-----------|----------------|-----|
| ± 0.3 | 1.8 | 5.5 | +0.1/-0.0 | 4.0 | ± 0.2 | 8.0 | 2.0 | ± 0.2 | ± 0.2 | 0.4 |

Tol.: $\pm 0.1 \text{ mm}$ unless otherwise specified

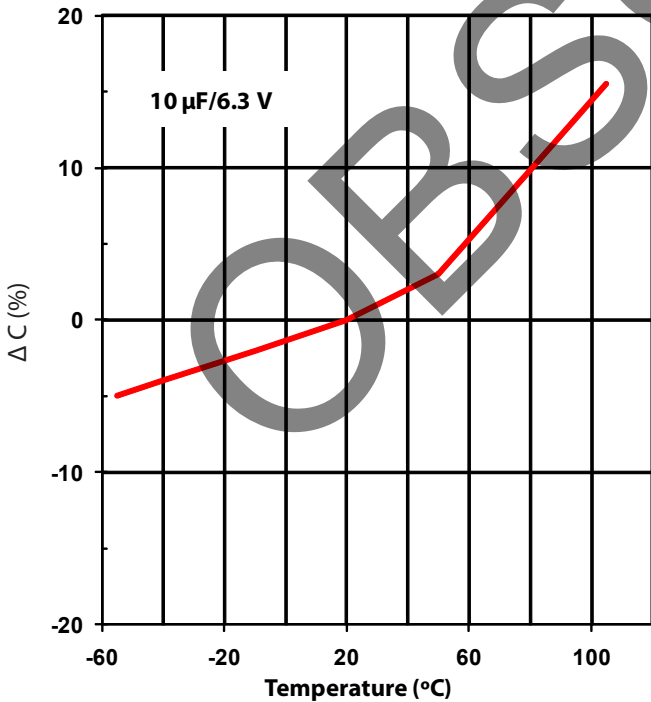
Reel Specifications



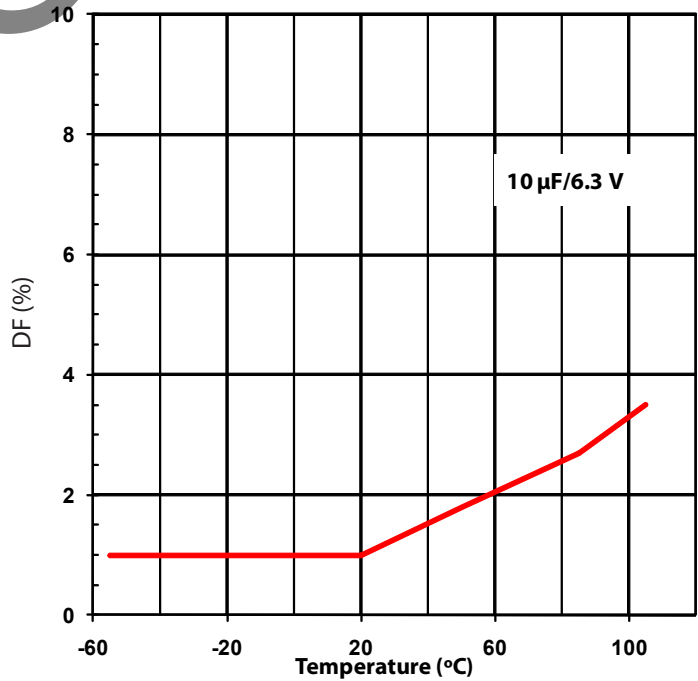
| A | B | C | D | E | W | t |
|-----------|------|-----------|-----------|-----------|-----------|-----|
| ± 0.2 | Min. | ± 0.5 | ± 0.8 | ± 0.5 | ± 1.0 | |
| 333.0 | 50.0 | 13.0 | 21.0 | 2.0 | 14.0 | 3.0 |

Typical Temperature Characteristics

Capacitance Change at 120 Hz

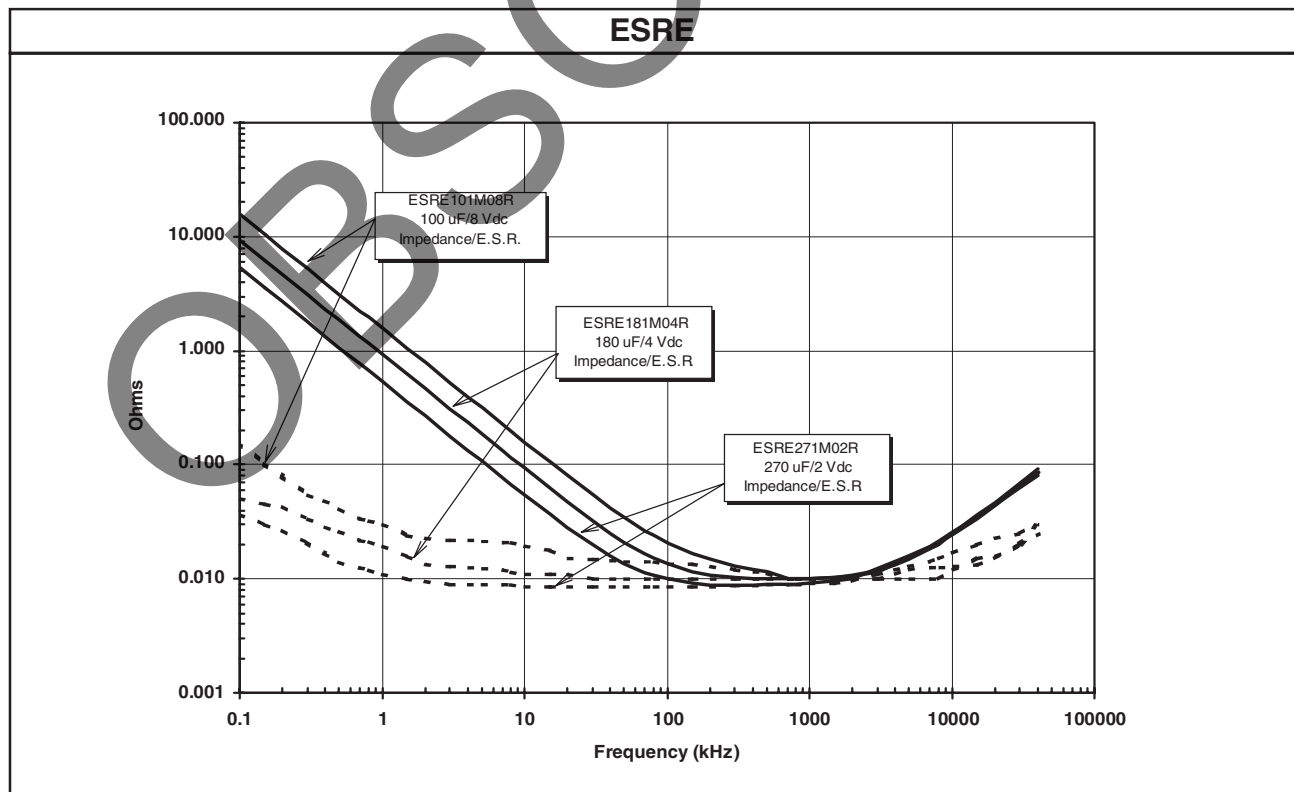
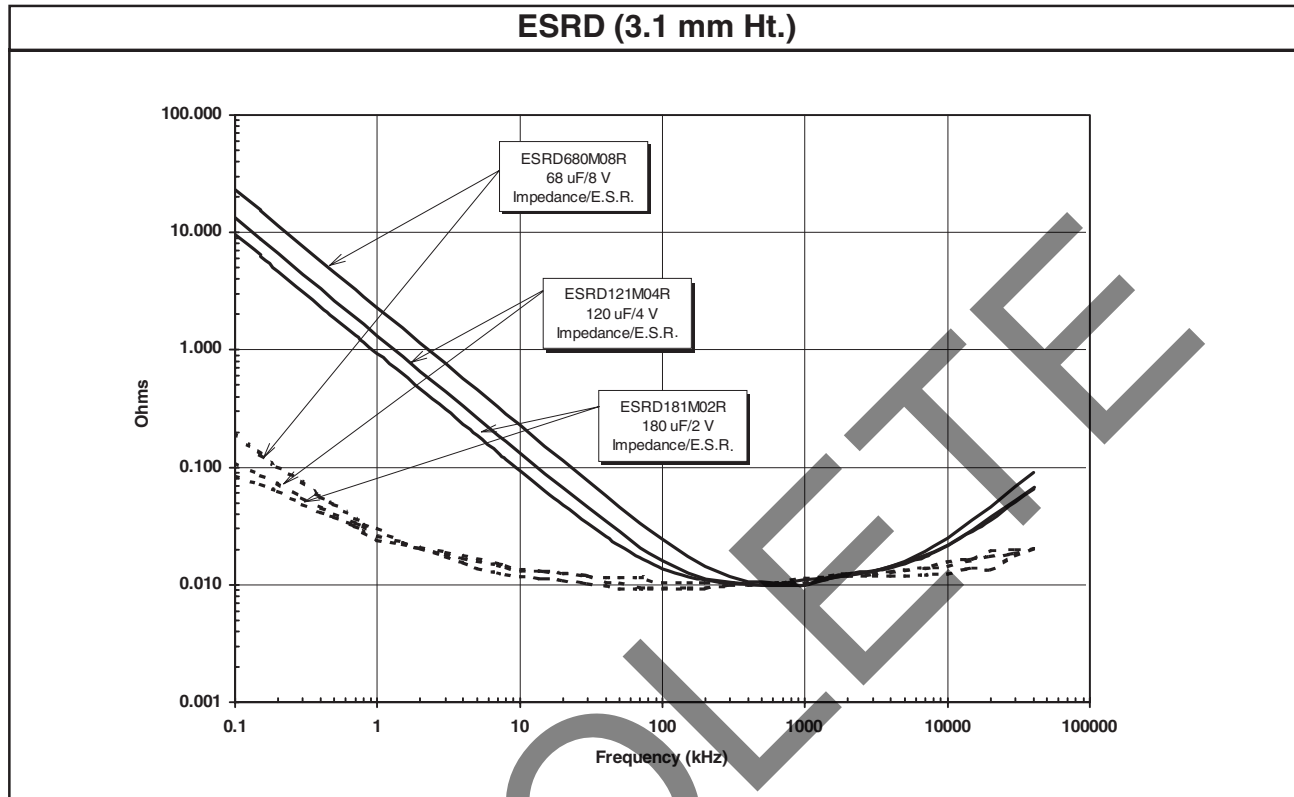


Dissipation Factor at 120 Hz



Solid Polymer Aluminum SMT Capacitors

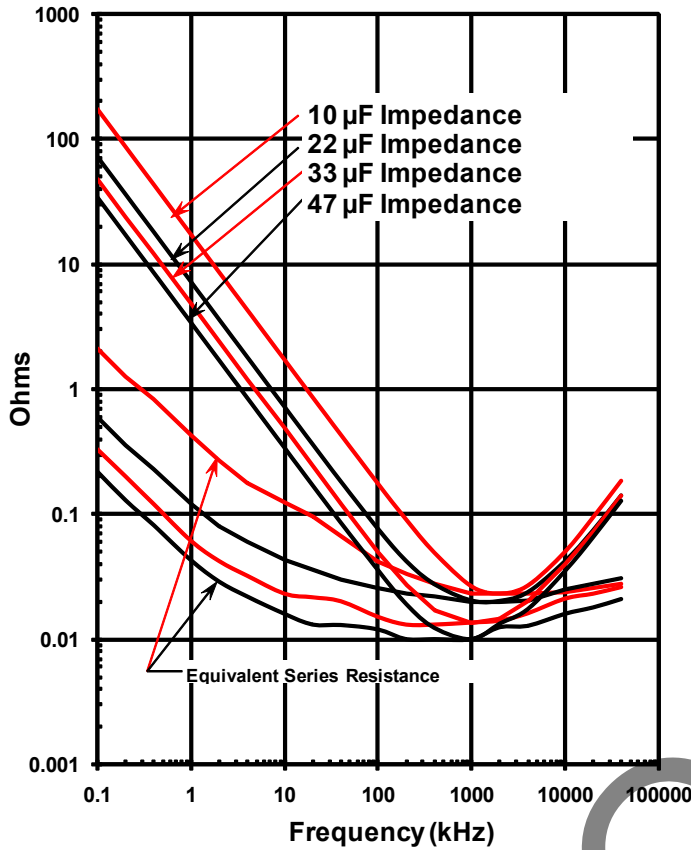
Typical Impedance and Equivalent Series Resistance



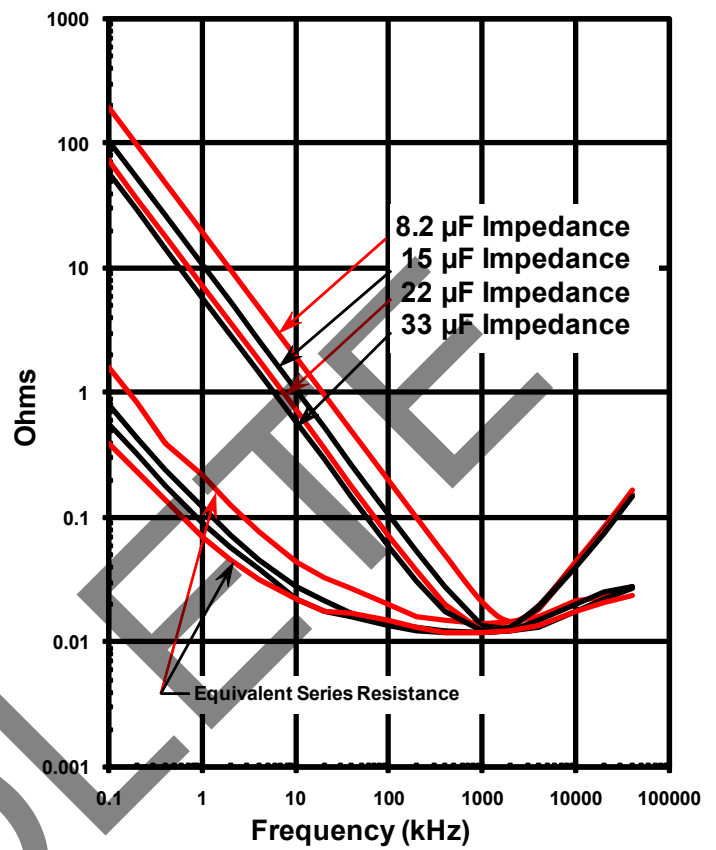
Solid Polymer Aluminum SMT Capacitors

Typical Impedance and Equivalent Series Resistance

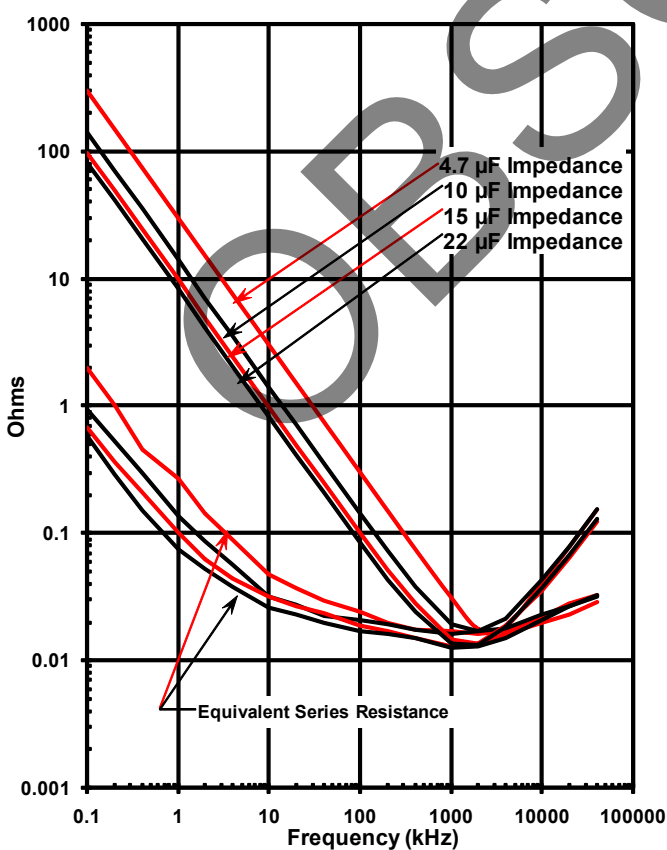
ESRD - 6.3 Vdc



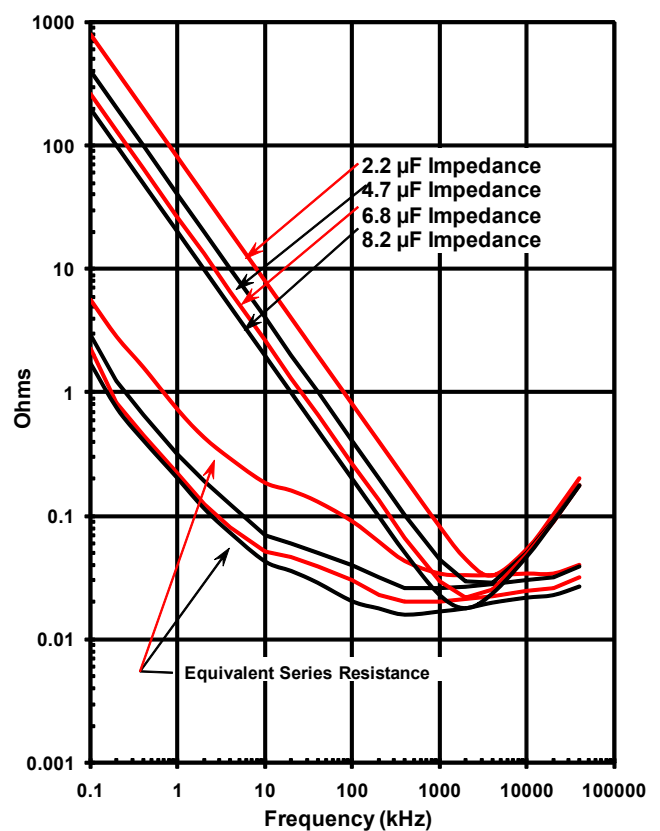
ESRD - 8.0 Vdc



ESRD - 12.5 Vdc



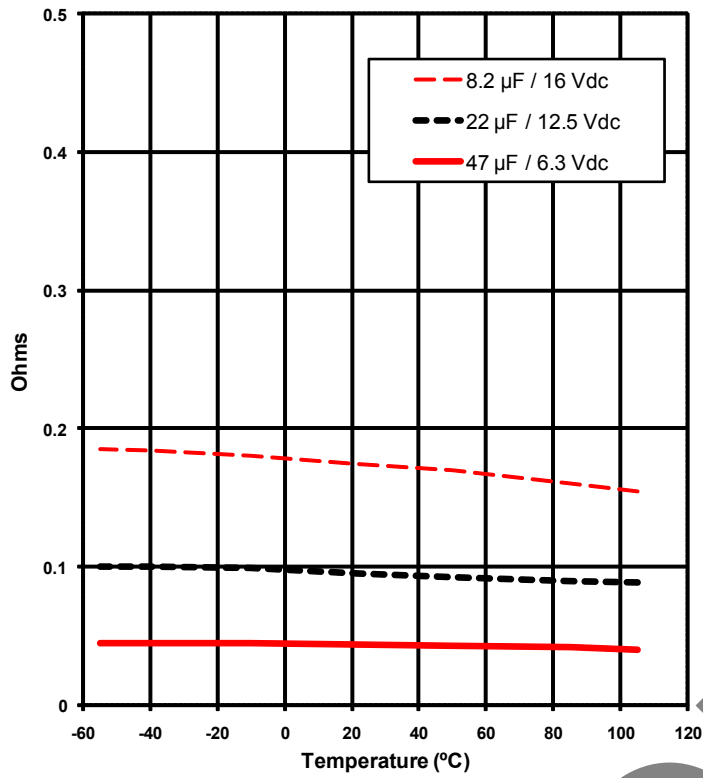
ESRD - 16.0 Vdc



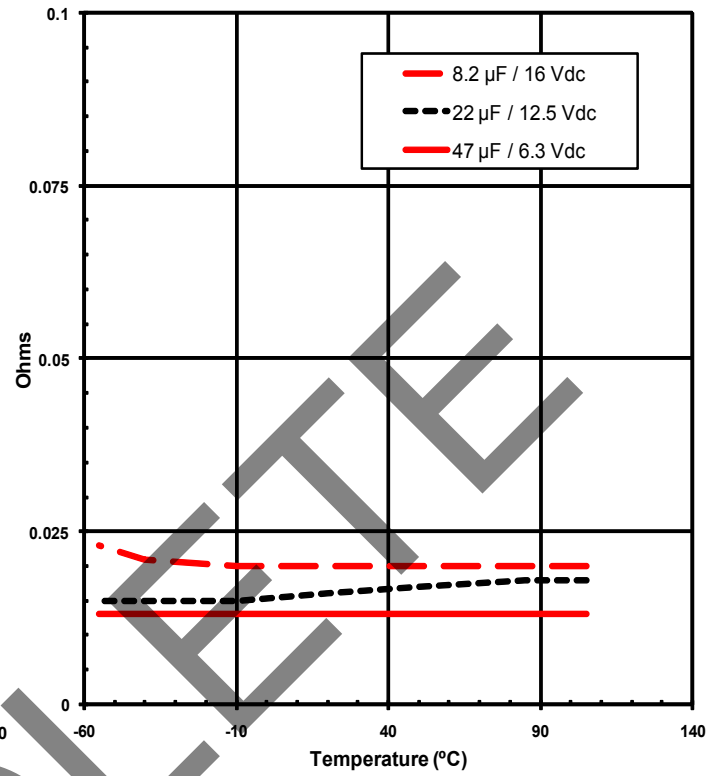
Solid Polymer Aluminum SMT Capacitors

Typical Temperature Characteristics

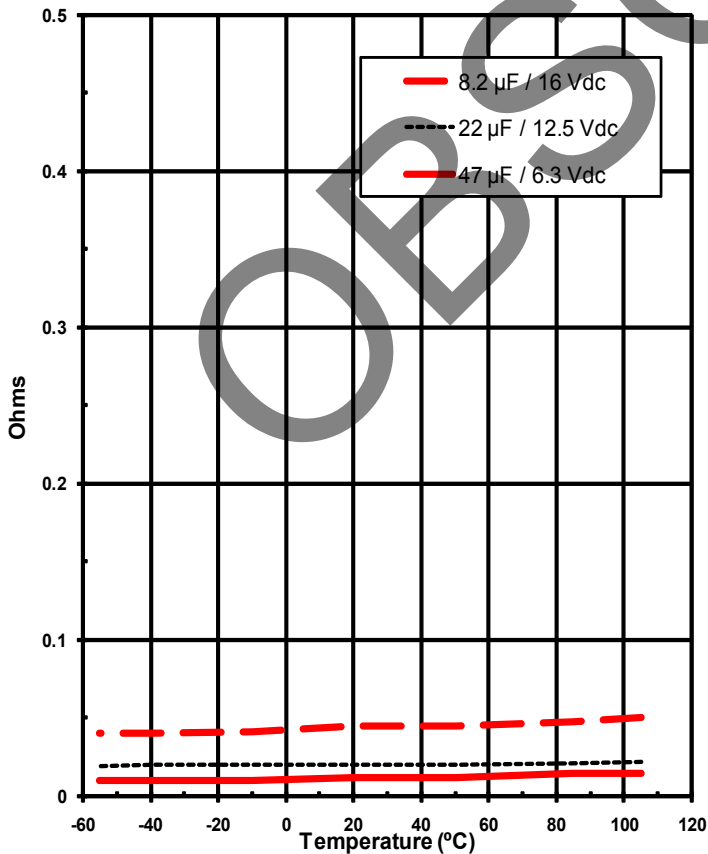
Impedance at 100 kHz



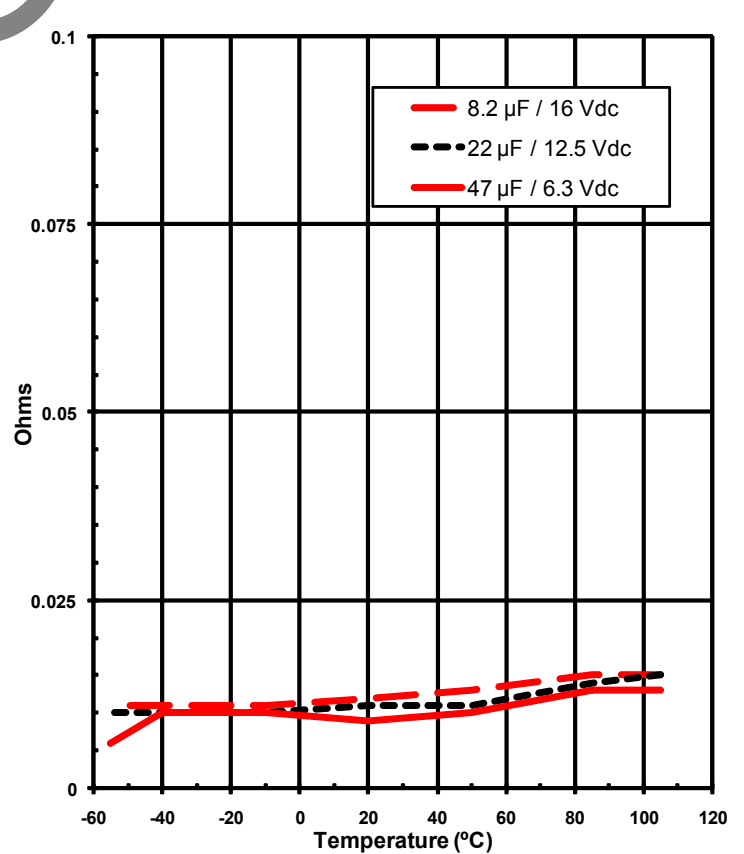
ESR at 100 kHz



Impedance at 400 kHz



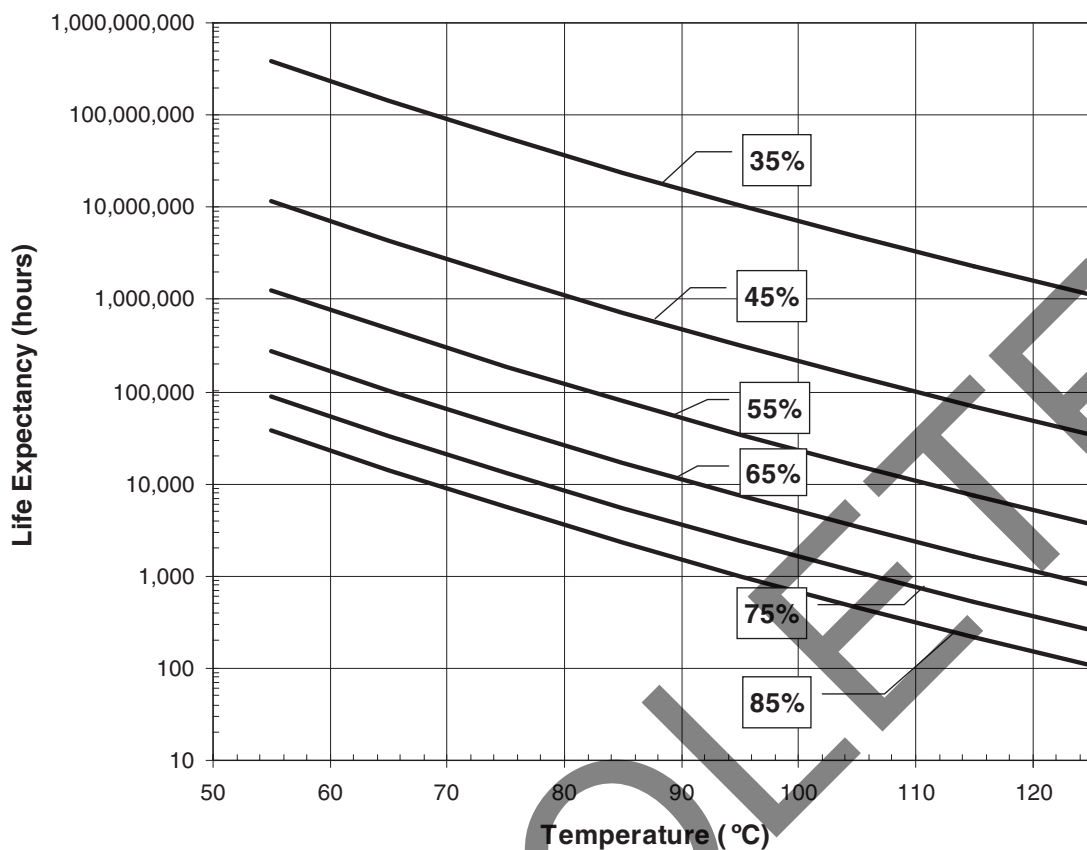
ESR at 400 kHz



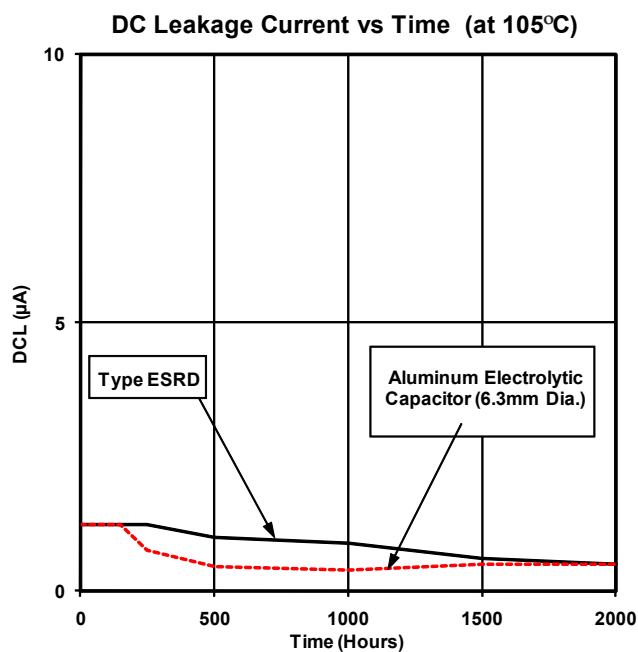
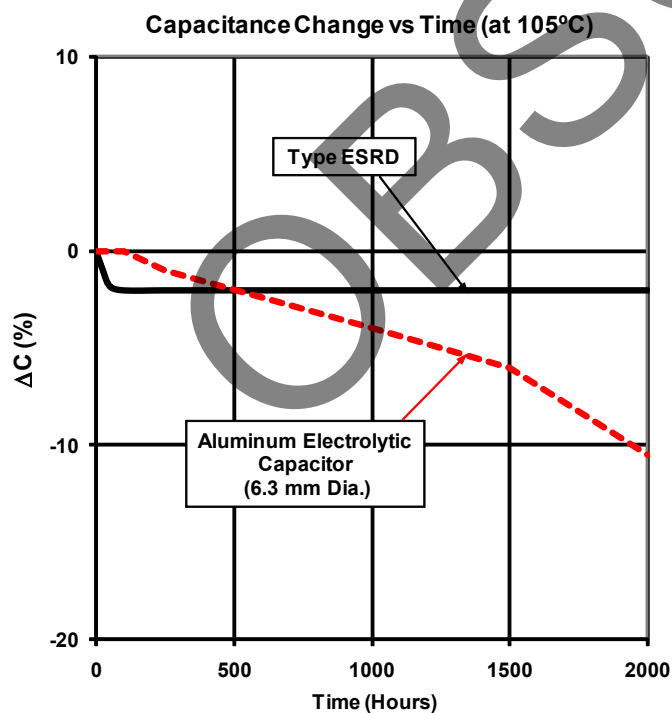
Solid Polymer Aluminum SMT Capacitors

Life Expectancy

Life Expectancy vs Temperature and Relative Humidity



Endurance Test Data



Solid Polymer Aluminum SMT Capacitors

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 Solid Polymer Aluminum capacitor can fail short circuit.

Ripple Current/Ripple Voltage

AC voltage as part of the capacitor's 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's internal temperature. Exceeding the specific maximum ripple current will overheat and damage 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.

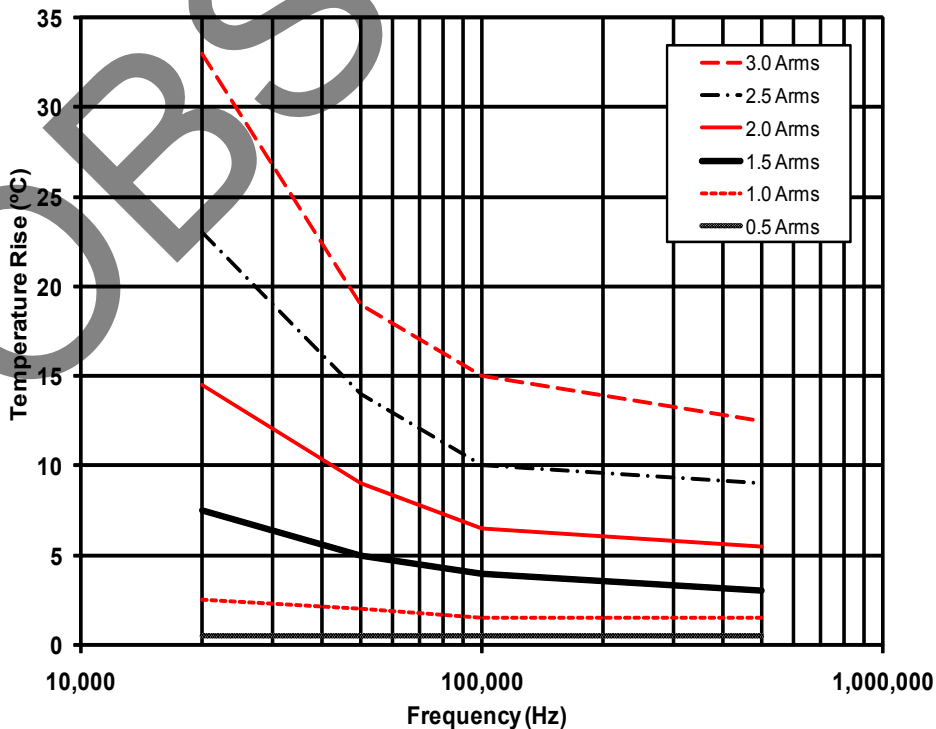
Reverse Voltage

Solid Polymer Aluminum 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.

Shelf Life

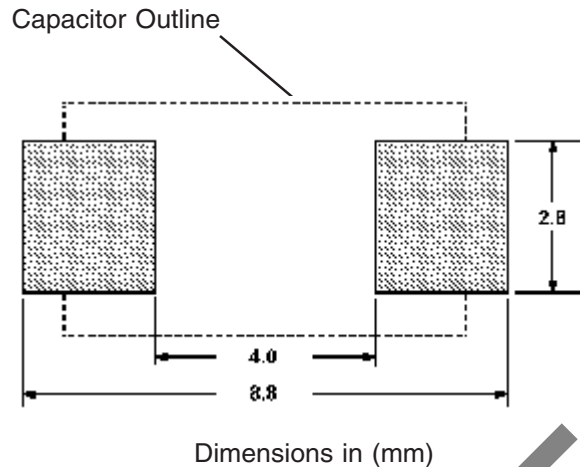
When stored at room temperature, in low humidity, and out of direct sunlight, Solid Polymer Aluminum capacitors have a storage life of 5 to 10 years. Storage at high humidity over long periods of time can cause the DC leakage current to increase. However, the application of rated voltage will reduce the DC leakage current to normal limits.

Temperature Rise from Ripple Current
(47 μ F/6.3 Vdc)



Solid Polymer Aluminum SMT Capacitors

Recommended Circuit Board Mounting Pads



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.

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.

Reflow Soldering

The graphs on the next page give the maximum recommended capacitor surface temperature during reflow soldering.

Cleaning

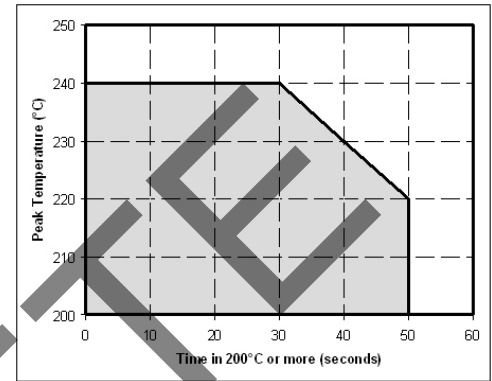
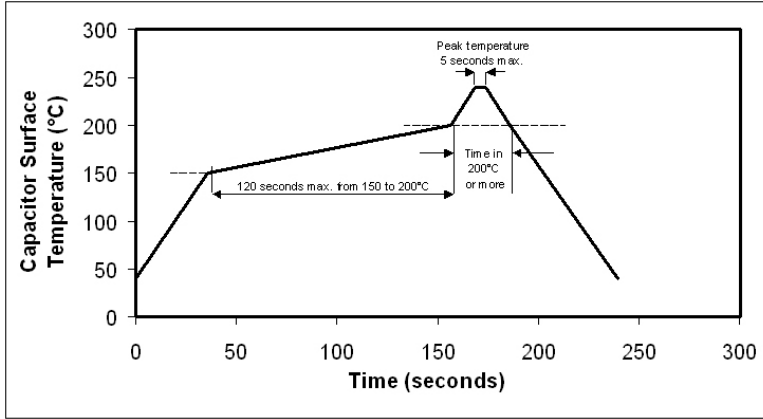
The capacitors can withstand for 5 minutes at 60 °C the following cleaning solvents by dipping or ultrasonic methods:

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

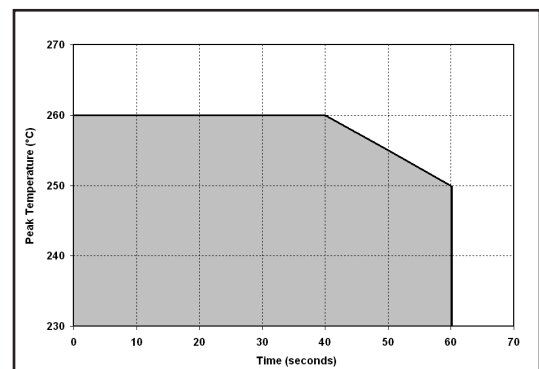
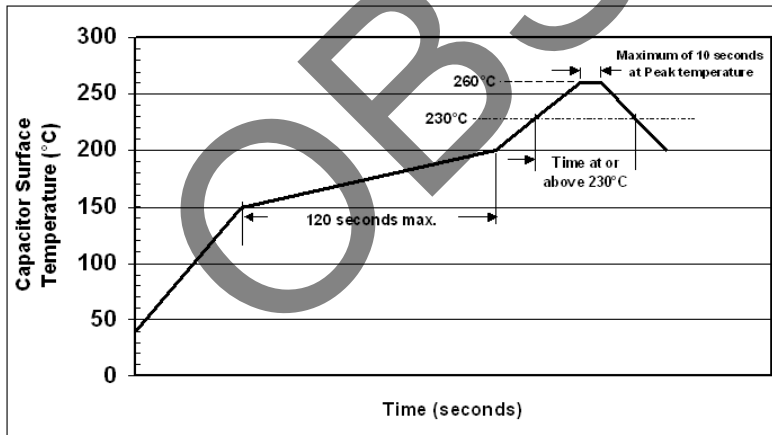
After cleaning, wash the circuit board with water for about 3 minutes, and dry at 100 °C for 20 minutes.

Solid Polymer Aluminum SMT Capacitors

Reflow Soldering Profile, ESRD, ESRE, ESRH and SPA



Reflow Soldering Profile, SPSX and SPCX



Solid Polymer Aluminum SMT Capacitors

Up to 50 Years Life

Solid Polymer Aluminum 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, Solid Polymer Aluminum 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 Ripple 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. Solid Polymer Aluminum'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 Solid Polymer Aluminum's polymer electrolyte is several orders of magnitude less than that of other electrolytes, the equivalent series resistance is almost zero.

Construction

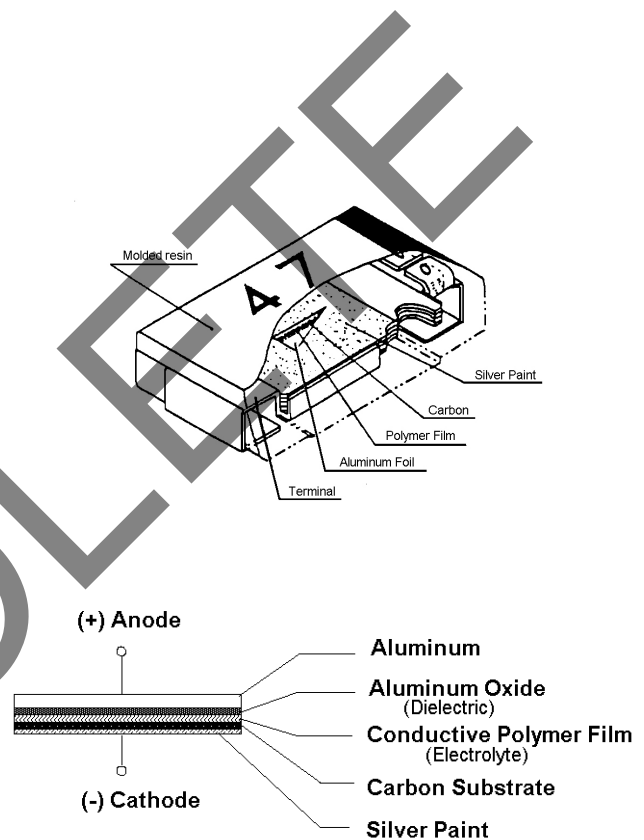
Construction is a unique combination of the elements of aluminum electrolytic and solid tantalum capacitors.

Like conventional aluminum electrolytic capacitors, the anode in Solid Polymer Aluminum 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 Solid Polymer Aluminum 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 Solid Polymer Aluminum 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

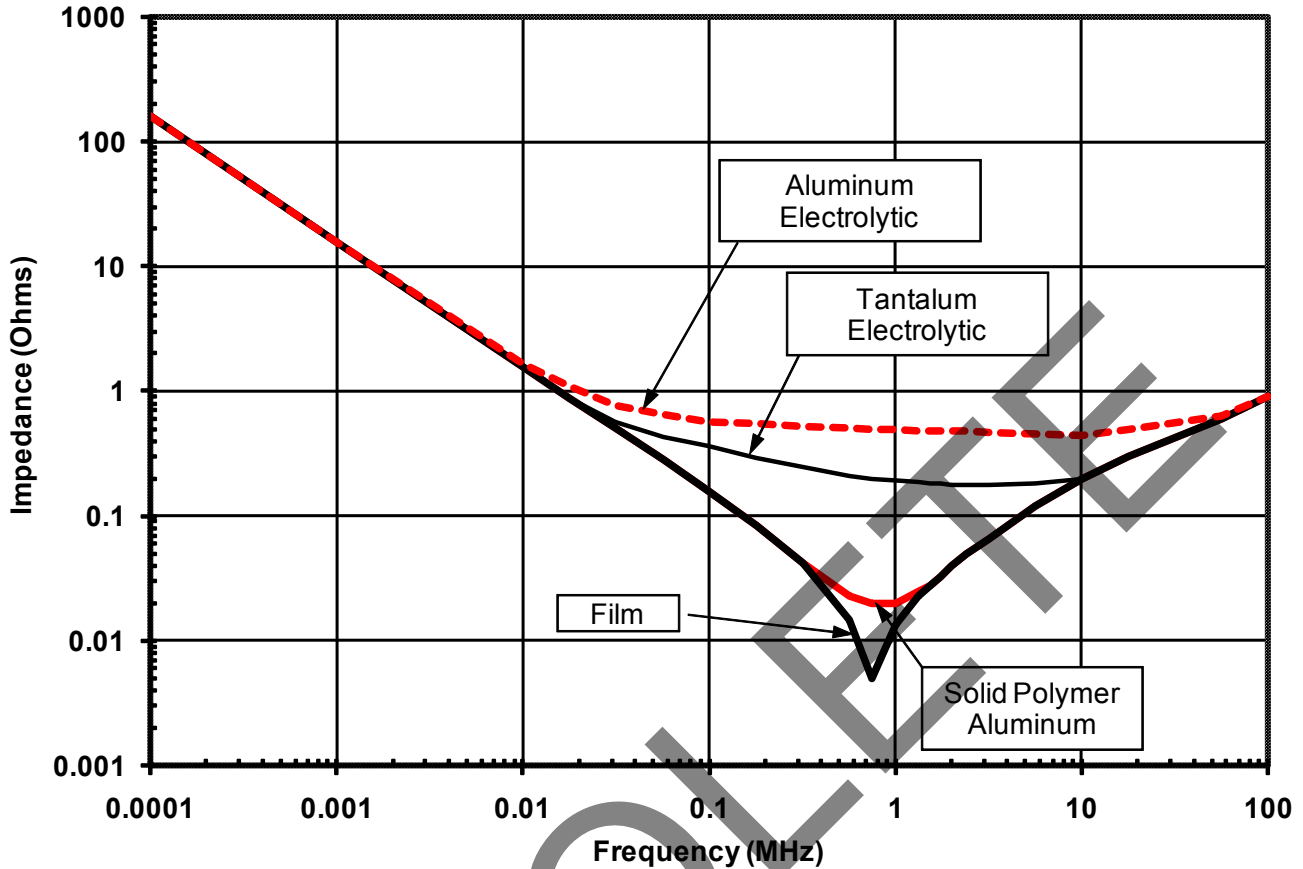
manganese dioxide is used as the electrolyte.

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 or copper clad steel.

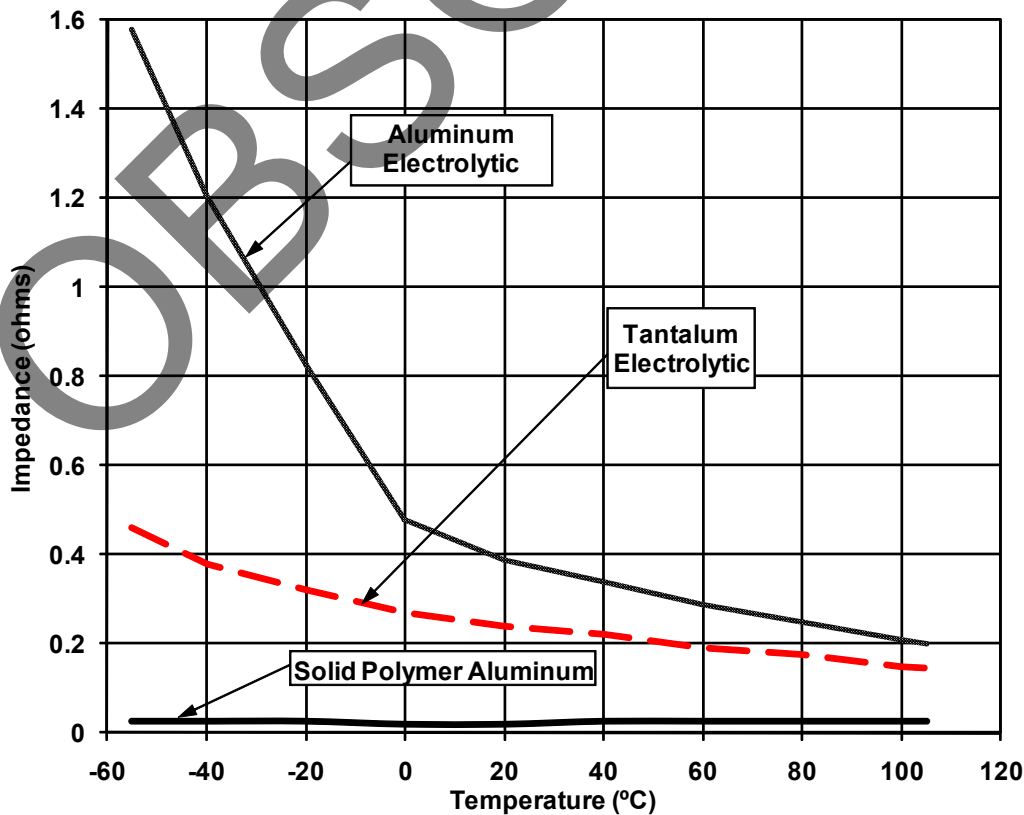


Solid Polymer Aluminum SMT Capacitors

Solid Polymer Aluminum Compared to Other Electrolytics



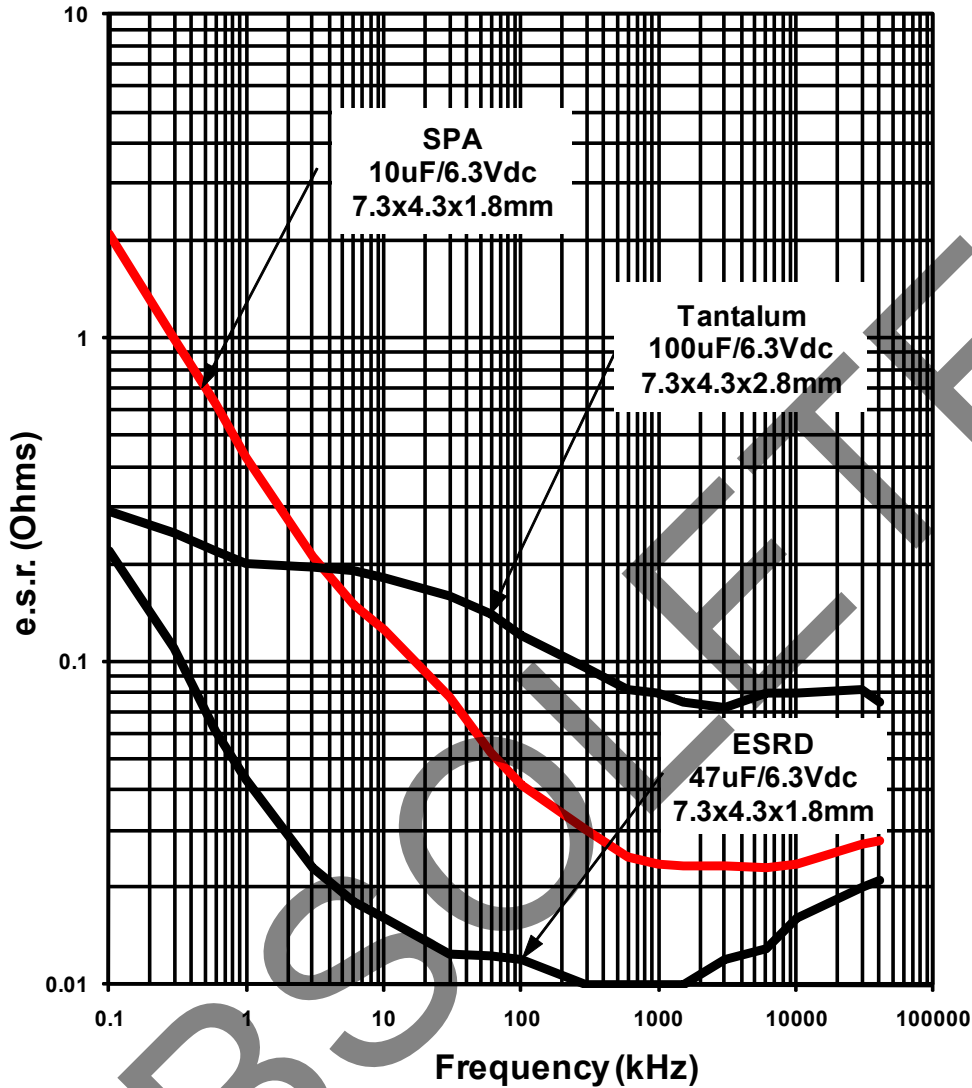
Solid Polymer Aluminum capacitors have lower impedance at high frequencies than the same values of wet electrolyte aluminum capacitors and solid tantalum capacitors.



Solid Polymer Aluminum capacitors have stable impedance over the entire temperature range.

Solid Polymer Aluminum SMT Capacitors

Solid Polymer Aluminum vs Solid Tantalum

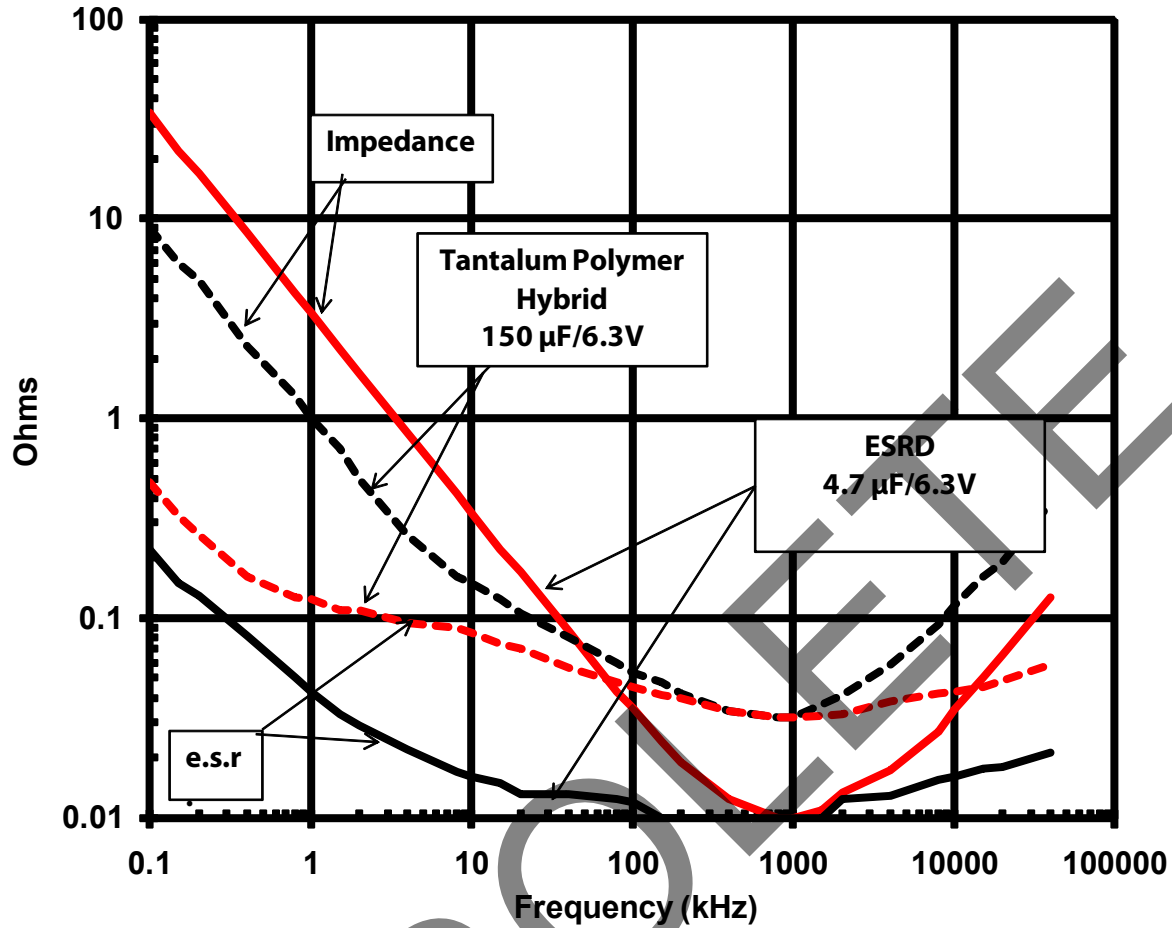


| Frequency | 100 μ F Tantalum Capacitor | | 47 μ F Solid Polymer Aluminum Electrolytic Capacitor | |
|-----------|--------------------------------------|---------------------------|--|---------------------------|
| | Equivalent Series Resistance | Impedance Magnitude Z | Equivalent Series Resistance | Impedance Magnitude Z |
| | (Ω) | (Ω) | (Ω) | (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 |

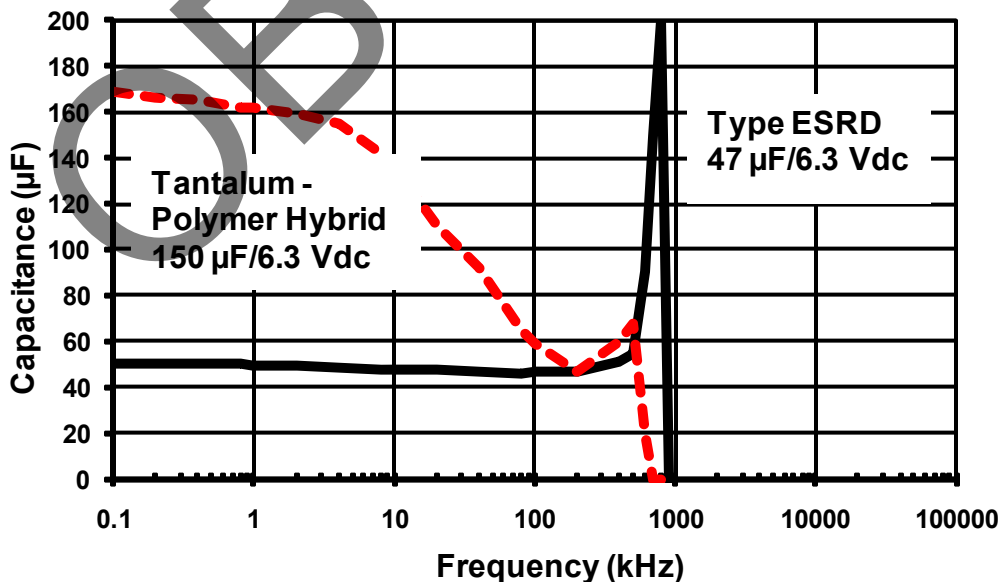
At 1 MHz the Solid Polymer Aluminum capacitor will provide almost 8 times more ripple and noise attenuation (.08/.01) as compared to the tantalum capacitor.

Solid Polymer Aluminum SMT Capacitors

Solid Polymer Aluminum 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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OBSOLETE

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