Polymer and Hybrid Capacitor Product Overview

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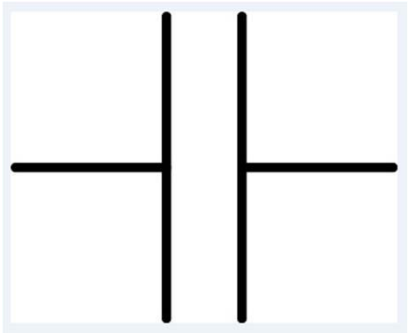
Capacitor Selection

Capacitors selection, to the uninformed, seems like a simple choice.

But the demands, challenges and expectations of modern electronics prove otherwise.

Design Engineers have many considerations when choosing the right capacitor for the job.

- Electrical Characteristics
- Stability
- Life and reliability
- Safety
- Cost



Many conventional capacitor technologies offer strong value propositions while no longer meeting the demands of today's challenging designs.

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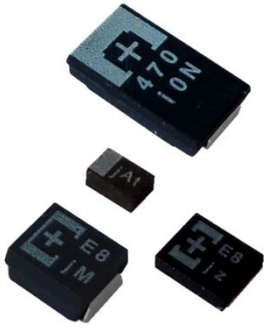
The Solution …

Advanced Polymer Capacitors from Panasonic provide solutions to these challenges.



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Why Switch to Polymer Technology?

- Requirements and challenges of high performance miniaturized modern electronic design combined with expectations of high reliability and long life
- Conventional capacitors are not up to the challenge
- Advanced Polymer capacitors provide higher performance in a reduced footprint while offering longer life and improved reliability!

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Polymer Capacitor Advantages

Polymer capacitors offer distinctive advantages over conventional capacitors in these specific areas:

- Stability
- Life
- Reliability
- Safety
- Component Reduction

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Capacitance Stability

Conventional Electrolytic and MLCCs suffer from capacitance drifts of up to 90% in response to temperature and DC bias.

Polymer Capacitors have no such problem.

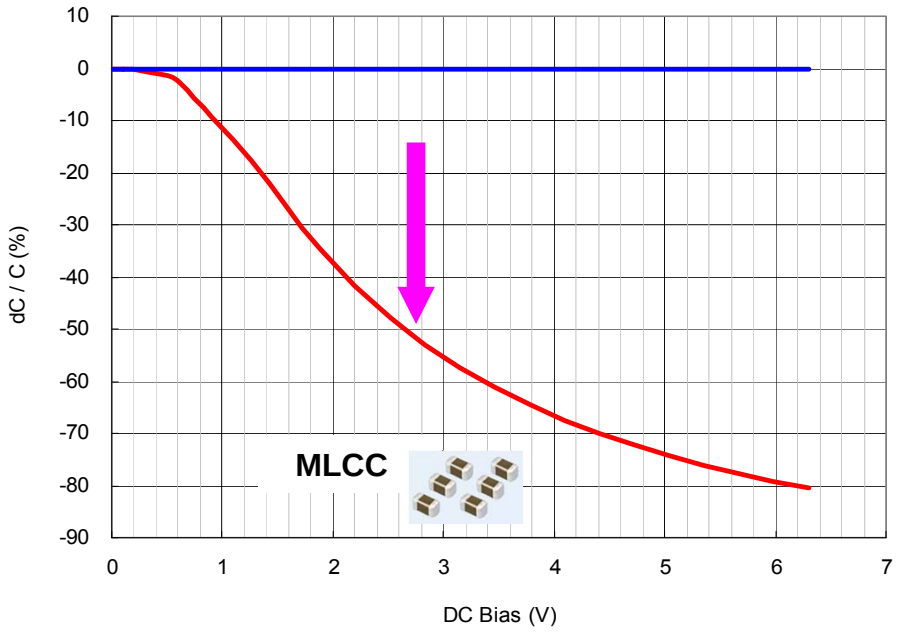
Stability

Versus MLCC

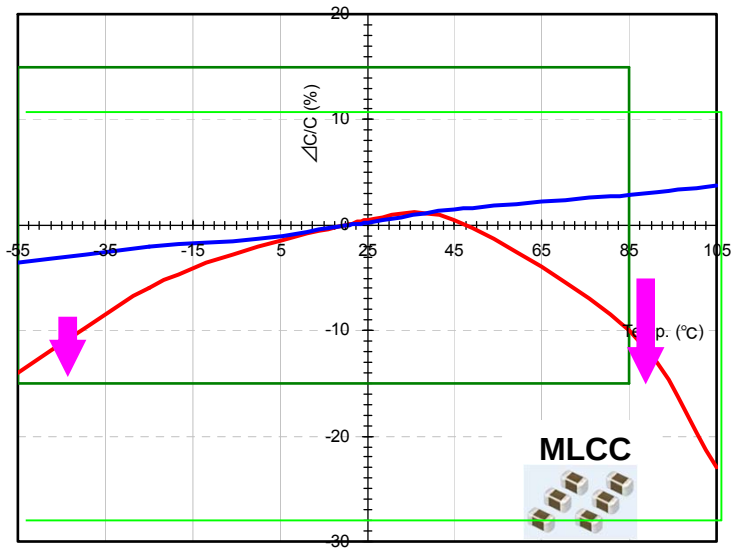
MLCC：6.3V47uF/3216/X5R

POSCAP/SP-Cap/OS-CON：6.3V47uF

DC biased characteristic



Temperature characteristic



POSCAP/SP-Cap/OS-CON are stable under actual use condition. (Temperature and DC Bias)

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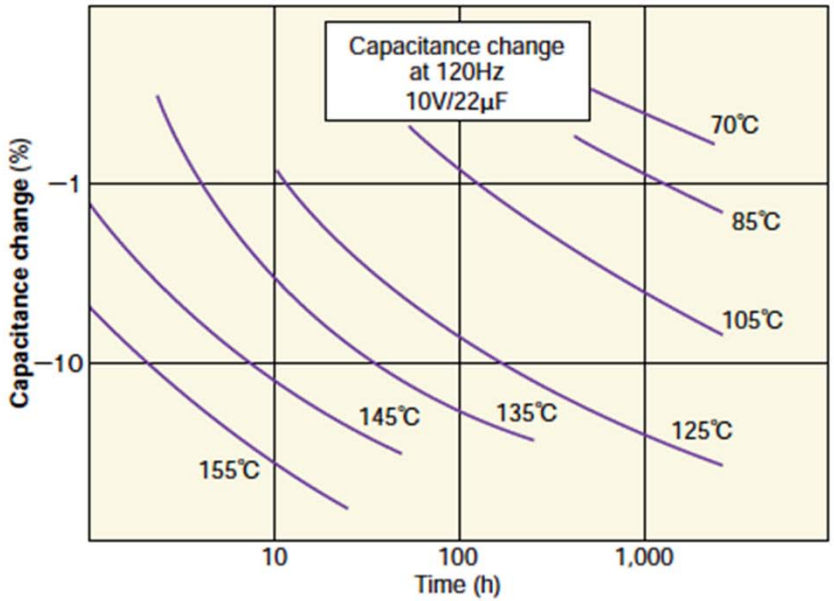
Life

1. Temperature acceleration test (Endurance)



The decrease in capacitance of the OS-CON depends on temperature. The left figure shows the speed of capacitance decrease at each temperature. This graph indicates that temperature coefficient of the OS-CON lifetime is 10 times by 20℃ reduction.
Compared with this, aluminum capacitor lifetime is 2 times by 10℃ reduction.

Estimation of life time

OS-CON	Aluminum electrolytic capacitor
105℃ → 2,000h	105℃ → 2,000h
95℃ → 6,324h	95℃ → 4,000h
85℃ → 20,000h	85℃ → 8,000h
75℃ → 63,245h	75℃ → 16,000h

※Guarantee temperature of the OS-CON is 105℃, except for SEQP, SVQP and SVPD series.
※Time is an estimate, not guaranteed.

Though the OS-CON and an aluminum electrolytic capacitors are guaranteed on 2,000 hours at 105℃, the life span results in differences as temperature drops.
The OS-CON has a longer life span compared with an aluminum electrolytic capacitor.

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Reliability

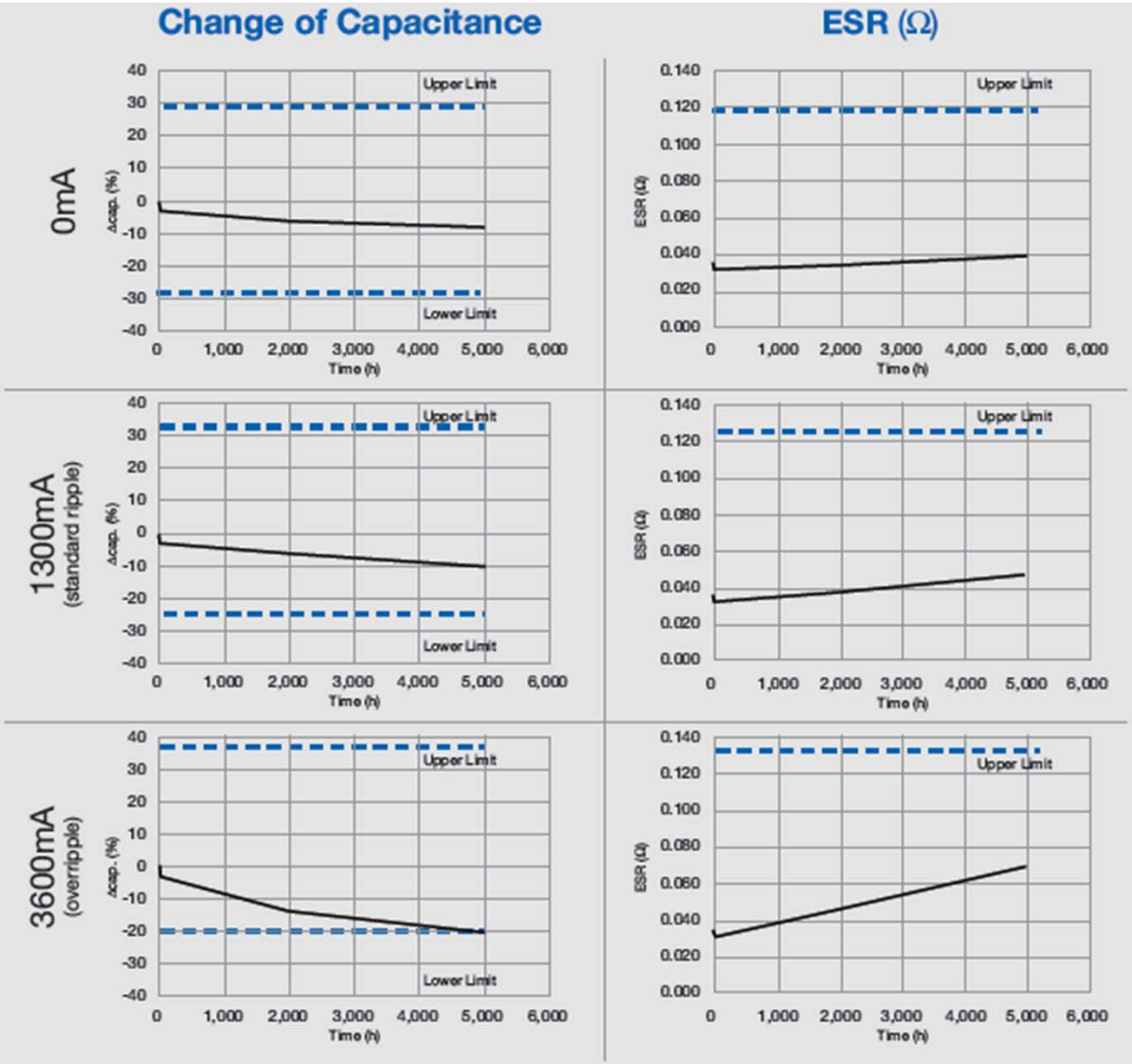

Figure 9

Hybrid capacitors exhibit high reliability when subjected to high ripple currents. In recent testing, the capacitors had the electrical characteristics at no load and rated ripple current (1300 mA) conditions. At three times the rated ripple current (3600 mA), the capacitor's electrical characteristics did change, but no shortage took place.

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Safety

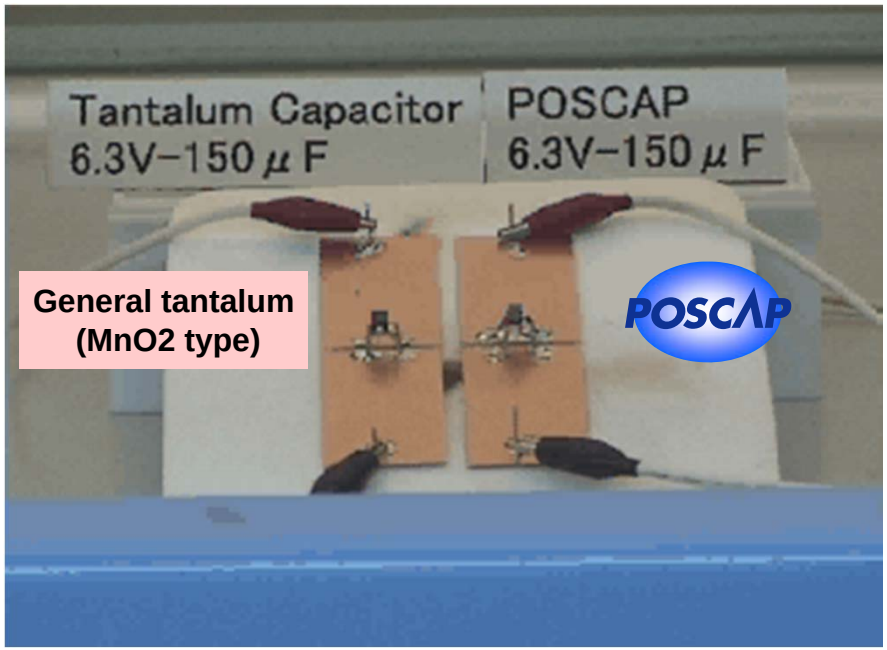
Over Voltage Test:

The test capacitors were made to short purposely.

Smoke and ignition were checked by the constant current examination.

SP-Cap vs. Tantalum Cap

POSCAP vs. Tantalum Cap

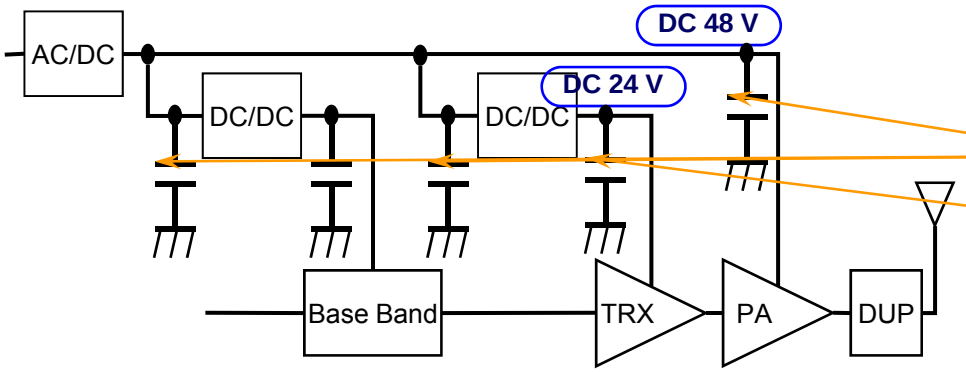


Applied Voltage :30V.DC, Limit current :6A max

This data is an experimental example. A numerical value and a phenomenon are not guaranteed.

Benign failure mode vs. catastrophic failure of tantalum cap (MnO_2)

Component Reduction



Aluminum Electrolytic Capacitors（SMD)

12.5×13.5 mm / 63 V / 220 uF × 4 pcs.

12.5×13.5 mm / 35 V / 680 uF × 4 pcs.

You can achieve high performance and miniaturization of equipment by adopting Hybrid Capacitor!!

Replacement Proposal

	DC 48V Line Solution		DC 24V Line Solution	
Capacitors	**Al. Electrolytic**	**Hybrid type Al. Electrolytic**	**Al. Electrolytic**	**Hybrid type Al. Electrolytic**
Item	**ϕ12.5 × 13.5 / 63 V / 220 μF × 4 pcs.**	**ϕ6.3 × 7.7 / DC 63 V / 22 μF × 2 pcs.**	**ϕ12.5 × 13.5 / 35 V / 680 μF × 4 pcs.**	**ϕ8.0 × 10.2 / DC 35 V / 150 μF × 2 pcs.**
Mounting Area	 100 % (491 mm²)	 **13 % (62 mm²)**	 100 % (491 mm²)	 **20 % (100 mm²)**
Endurance	105 ℃, 5,000 h	**105 ℃, 10,000 h**	105 ℃, 5,000 h	**105 ℃, 10,000 h**
Total ESR	40 mΩ / 100 kHz	**40 mΩ / 100 kHz**	15 mΩ / 100 kHz	**13.5 mΩ / 100 kHz**
Total Ripple	3200 mA / 100 kHz, 105 ℃	**3000 mA / 100 kHz, 105 ℃**	4400 mA / 100 kHz, 105 ℃	**4600 mA / 100 kHz, 105 ℃**
Life End Failure Modes	Open	**Open**	Open	**Open**
Total Cost	Index: 1	**Index: 0.5**	Index: 1	**Index: 0.58**

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Panasonic Polymer Capacitor

Panasonic has four Polymer Capacitor alternatives, each with distinct sweet spots that can address ideal voltages, frequency characteristics, environmental conditions and other application requirements that are challenging for conventional capacitors.

- SP-Cap®
  - Layered Polymer Aluminum Capacitors
- POSCAP®
  - Polymer Tantalum Capacitors
- Hybrid
  - Polymer Hybrid Aluminum Capacitors
- OS-CON®
  - Wound Polymer Aluminum Capacitors

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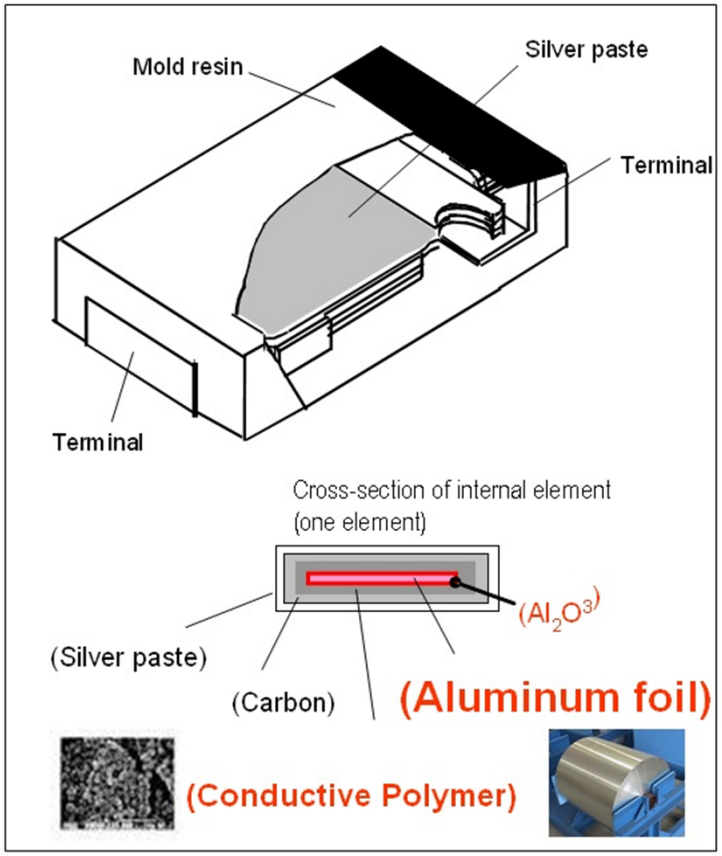
Panasonic Polymer Capacitor

SP-Cap®

Layered Polymer Aluminum Capacitor – polymer is used as the electrolyte with an aluminum cathode. SP-Caps are packaged in a molded resin surface mount package.

SP-Caps are available with a voltage rating from 2 to 25V and capacitance of 2.2 to 560uF. The distinguishing electrical characteristic of these polymer capacitors is their extremely low equivalent series resistance (ESR) as low as 3mΩ



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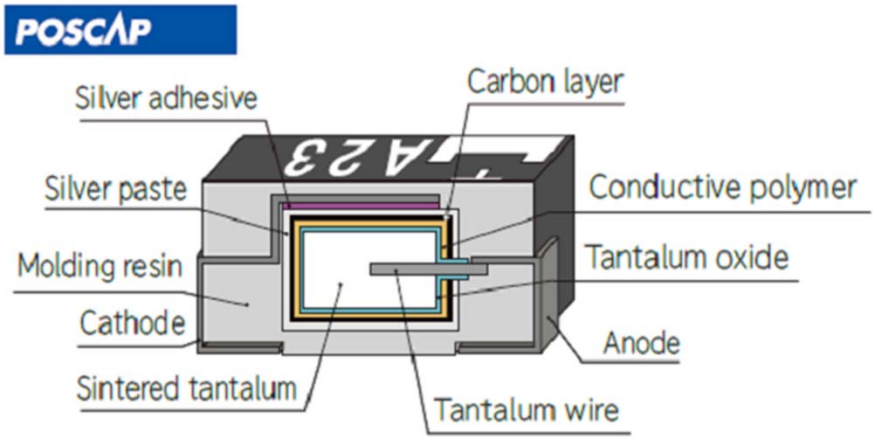
Panasonic Polymer Capacitors

POSCAP®

Polymer Tantalum Capacitors employ a polymer as the electrolyte and have a tantalum cathode. Packaged in a molded resin case, the tantalum polymer capacitors are among the most compact on the market. The M size measures just 1.6 by 0.8 mm.

POSCAP capacitors are available with a voltage rating from 1.8 to 35V and capacitances from 2.7 to 680µF They, too, have low ESR values as low as 5mΩ.



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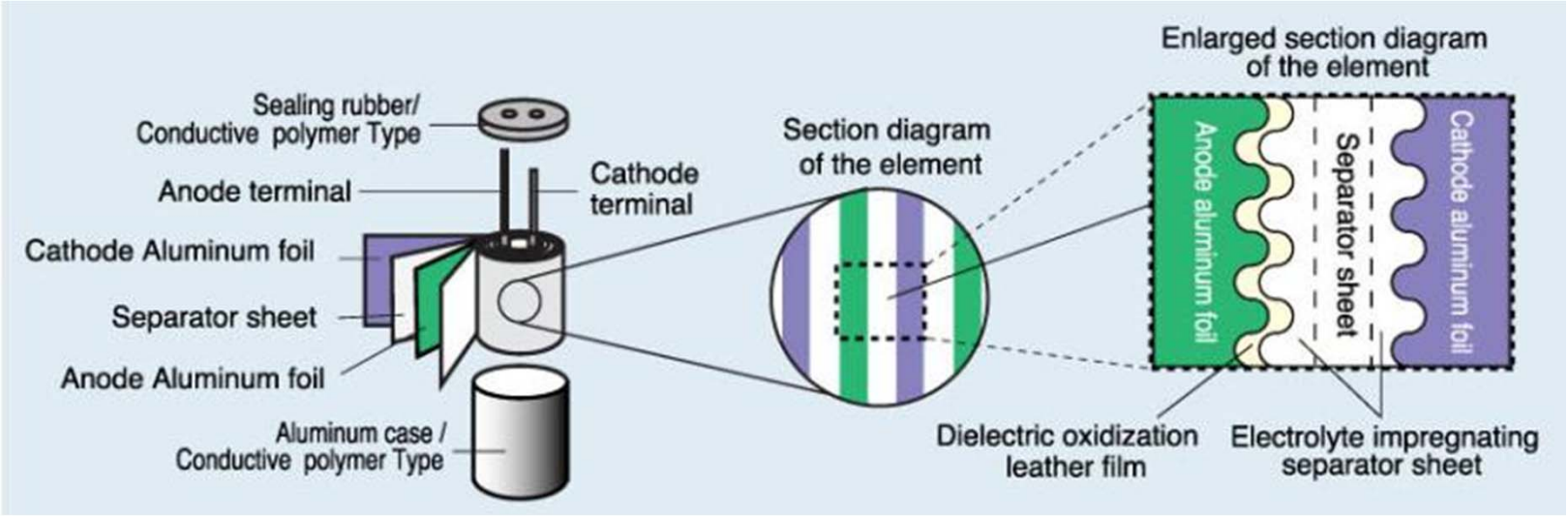
Panasonic Polymer Capacitors

OS-CON®

Wound Polymer Aluminum Capacitors utilize conductive polymer as the electrolyte and wound aluminum as the cathode. The polymer electrolyte yields very low ESR (below 5mΩ) while the wound aluminum cathode provides a large surface area enabling high capacitance.



OS-CON Capacitors are available in a voltage range of 2 to 50 VDC and capacitances from 3.3 to 2700µF.

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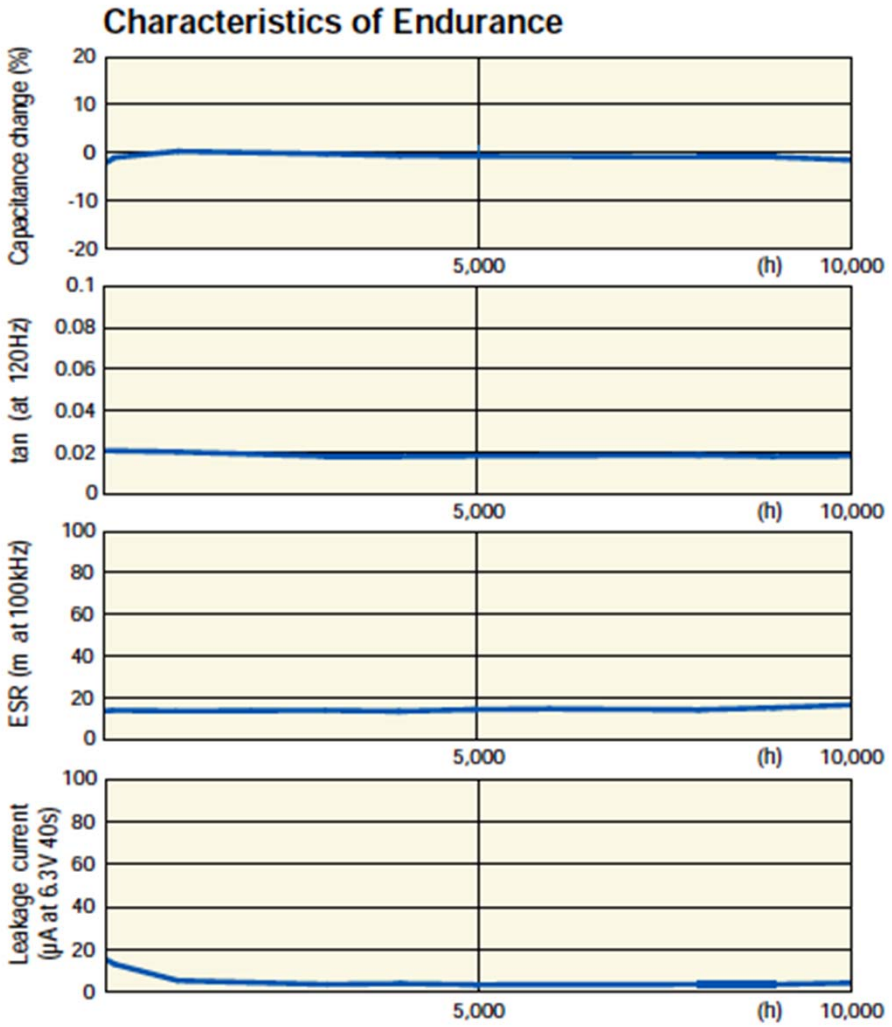
Life Formula – POSCAP & OS-CON

Calculating formula for the presumtion of life

$$Lx = Lo \times 10^{\frac{To - Tx}{20}}$$

Lx : Life expectance in actual use (temperature Tx) (h)
Lo : Guaranteed life at maximum temperature in use (h)
To : Maximum operating temperature ( )
Tx : Temperature in actual use (temperature of POSCAP) ( )

The data to the left shows the results of an endurance.
The POSCAP of the conductive polymer capacitor is excellent for heat stability.
(The characteristics of each models, please contact us.)



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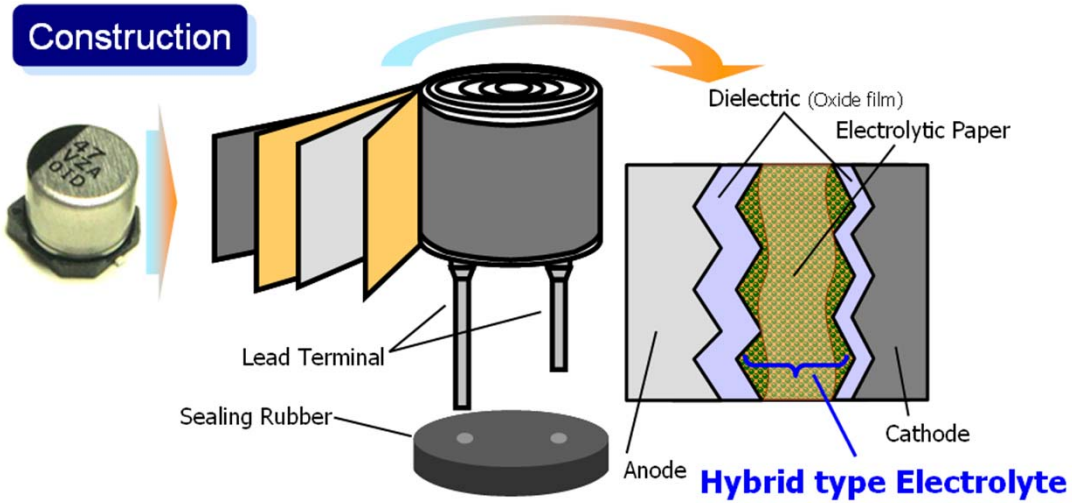
PANASONIC HYBRID

Polymer Hybrid Aluminum Capacitors use a combination of a liquid and polymer to serve as the electrolyte and aluminum as the cathode. This combination attains the best of polymer and electrolytic capacitor technology; low ESR of a polymer (20 to 120mΩ) along with high voltages and higher capacitance of an electrolytic.

Hybrid capacitors are available in a voltage range of 25 to 80V and capacitances between 10 and 330µF.



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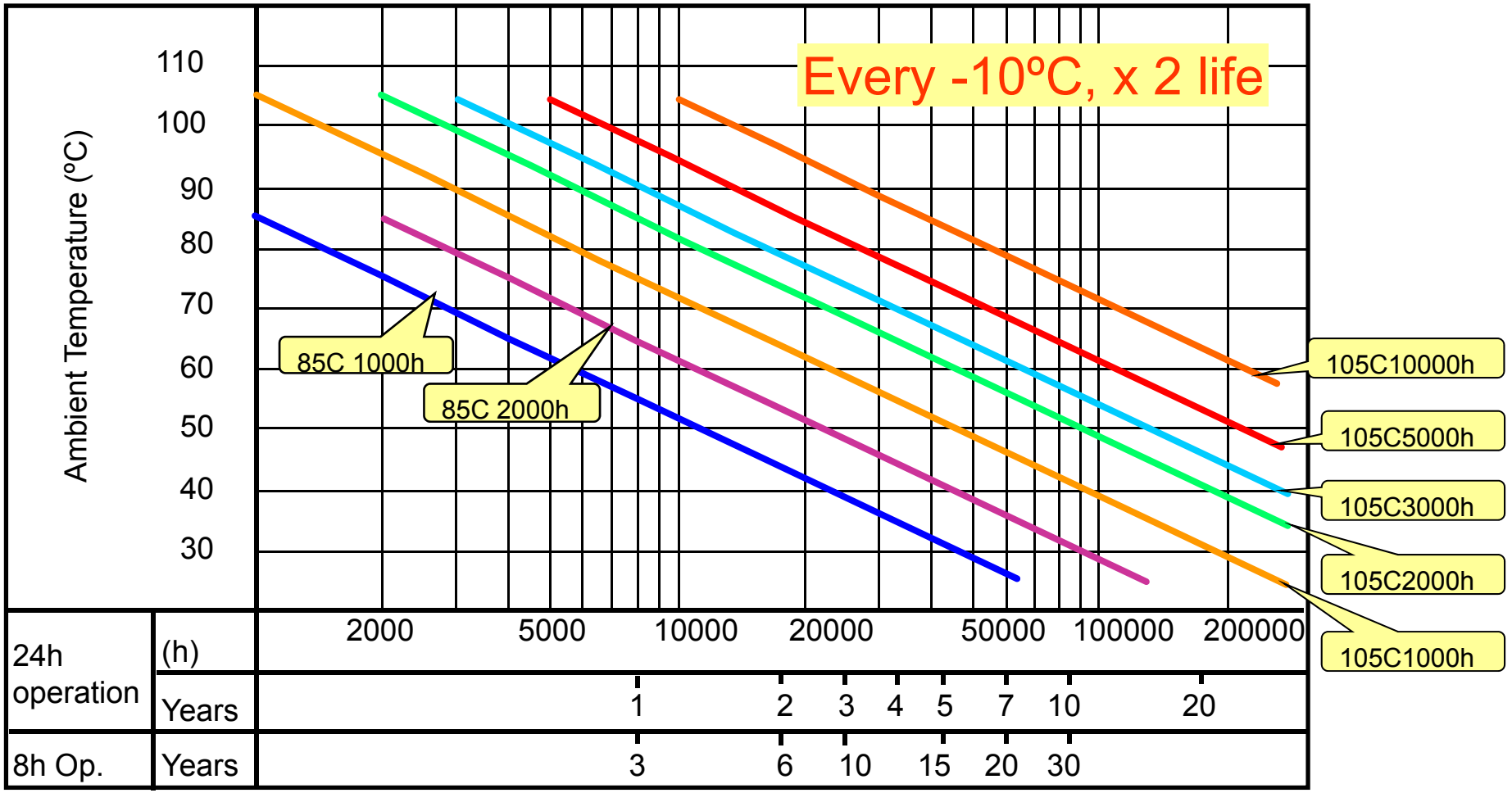
Aluminum Capacitor Life Calculation

Liquid electrolyte → Dry-up → Open Failure → Finite Life



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Choosing the Right Polymer Capacitor

- OS-CON and Hybrid vs. Lytic
- POSCAP and SP-Caps vs. Ceramic and/or Tantalum

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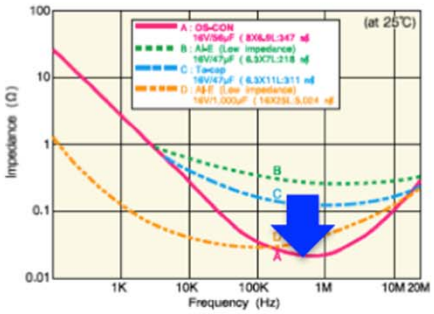
OS-CON and Hybrid

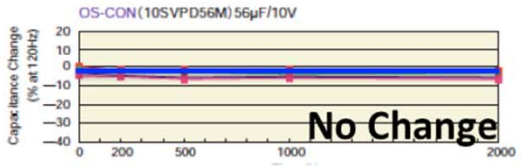
Key difference with Standard Aluminum Capacitor

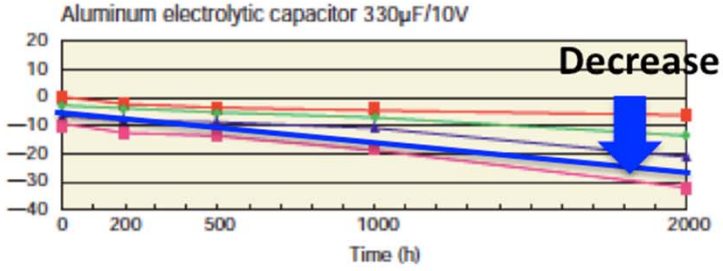
- Ultra Low ESR, Low impedance (as low 1/100 of a typical lytic)
- Higher ripple current capability (upwards of 3~5 times)
- Stable characteristics, longer life time (up to 15 years in case of OS-CON)

Good noise reduction

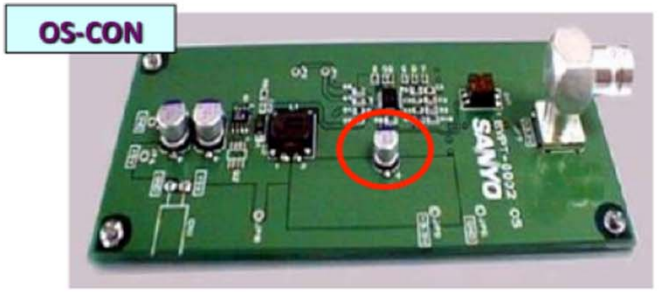


Stable characteristics, make longer life time

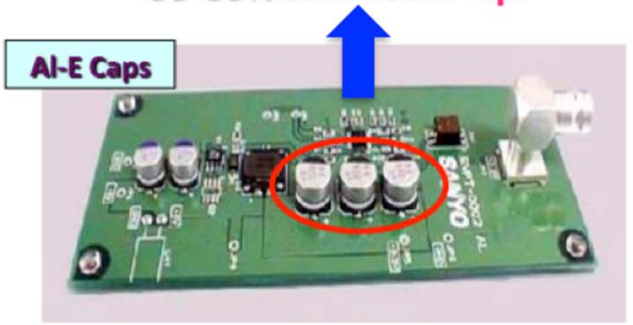




Can be replace from Standard Tantalum



OS-CON *6SVP100M* 1p.



Al-E Caps 6V/680uF 3pcs.

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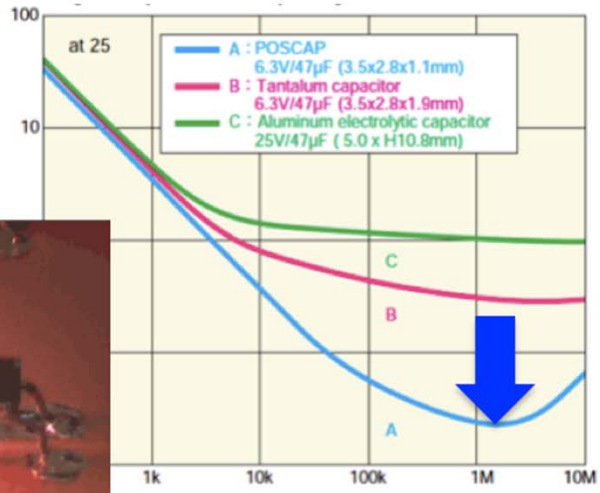
POSCAP and SP-Cap

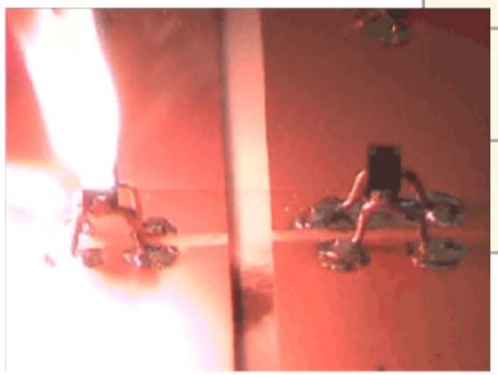
Key with Standard Tantalum Capacitor and MLCC

- Ultra Low ESR, Low impedance (as low as 1/100)
- High reliability (does not explode like a Tantalum)
- SP-Cap: no derating.
- No Piezo effect for both POSCAP and SP-Cap (unlike MLCC)

Good noise reduction

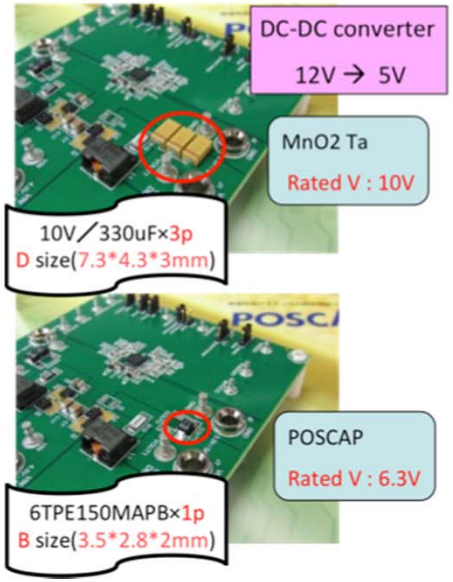


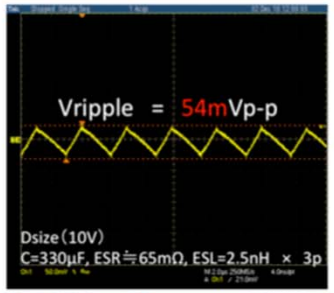
Safety Mechanism

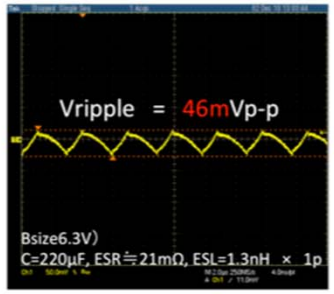


Standard Tantalum POSCAP

Can be replace from Standard Tantalum







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Replacement from MLCC to POSCAP/SP-Cap

MLCC → POSCAP

AntiNoise MLCC

size 3517
25V 10uF x 8 pcs

Murata:KMR31FR61E106KH01K

Actual Cap. Approx. 15uF
(3.5 x 1.7) x 8 pcs = 48mm²

POSCAP x 1pcs

25TQC15MYFB

Actual Cap.
25V → 15uF

(3.5 x 2.8) x 1 pcs = 9.8mm²

Condition

Large current power supply circuit

Benefit

1. Cost 50%off
2. Space 80% off
3. Same Capacitance

MLCC → SP-Cap

High Voltage MLCC

Size 3225
27uF x 5 pcs

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SP-Cap x 1pcs

EEFSX0D471E4
EEFLXoD471R4

Actual Cap.
1.5V → 470uF

(7.3 x 4.3) x 1 pcs = 31mm²

Condition

Large current DC/DC or LSI

Benefit

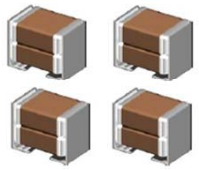
1. Cost 30%off
2. Space 25% off

Replacement from MLCC to OS-CON

MLCC ➔ OS-CON

High Voltage MLCC

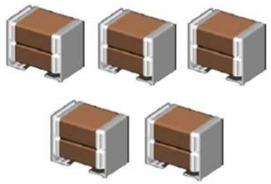
size 5750
100V 22uF x 4 pcs



TDK:CKG57NX7S2A226M500JH

Actual Cap. Approx. 15uF
(6.1 x 5.3) x 4 pcs = 129mm²

size 5750
50V 22uF x 5 pcs



TDK:CKG57NX7S1H226M500JH
Murata:KRM55WR71H226MH01K

OS-CON x 1pcs

100SXV15M
63SXV33M

Actual Cap.

100V ➔ 15uF
63V ➔ 33uF

(8.3 x 8.3) x 1 pcs = 69mm²

Condition

High voltage & Large current power supply circuit

BENEFIT

1. **Cost 70~80%off**
2. **Space -47%~58% off**
3. **Same Capacitance**

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Replacement from MLCC + Radial AL to Hybrid

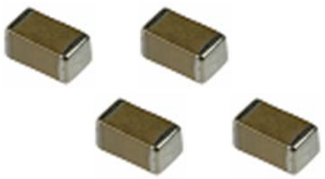
MLCC + E-CAP → Hybrid

High Voltage MLCC +

Radial E-CAP

size 5750

100V 22uF x 4 pcs



+

size φ10x12.5mm

25V 220uF x 1 pcs

Mount Area = 110mm²

ESR = 110mΩ

Ripple= 680mA

Hybrid-Cap x1pcs

EEHZC1E221P

size φ8x10.2mm

Mount Area = 69mm²

ESR = 20mΩ

Ripple= 1600mA

Condition

High voltage & Large current power supply circuit

BENEFIT

1. **Space -58% off**
2. **Same Capacitance**
3. **Low ESR/High ripple**

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Polymer and Hybrid Capacitor Product Overview

Thank You!

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