

**Technology:**

**Hybrid Electrolyte** Aluminum Electrolytic Capacitors [[Comparison](#)] [[Developments](#)]

**Applications:**

Power supplies, DC-DC converters, Voltage regulator modules (VRMs), On-board voltage management applications

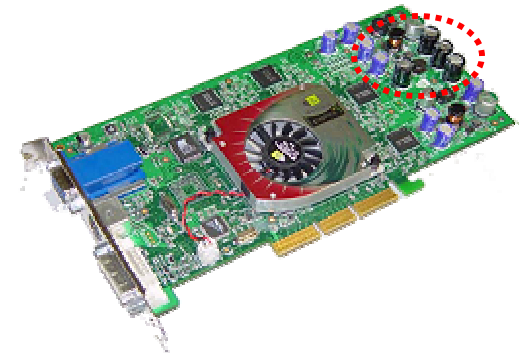
**End Markets - Products:**

Communication, Computers; Workstation & PC, DSC, Car Navigation, IP-phone, LCD Displays & PDAs, Graphics; integrated graphics/chipsets for desktops and notebooks & game consoles

**NIC Series:** [NSPE](#) (SMT) & [NSPER](#) (LDD)

**Features:**

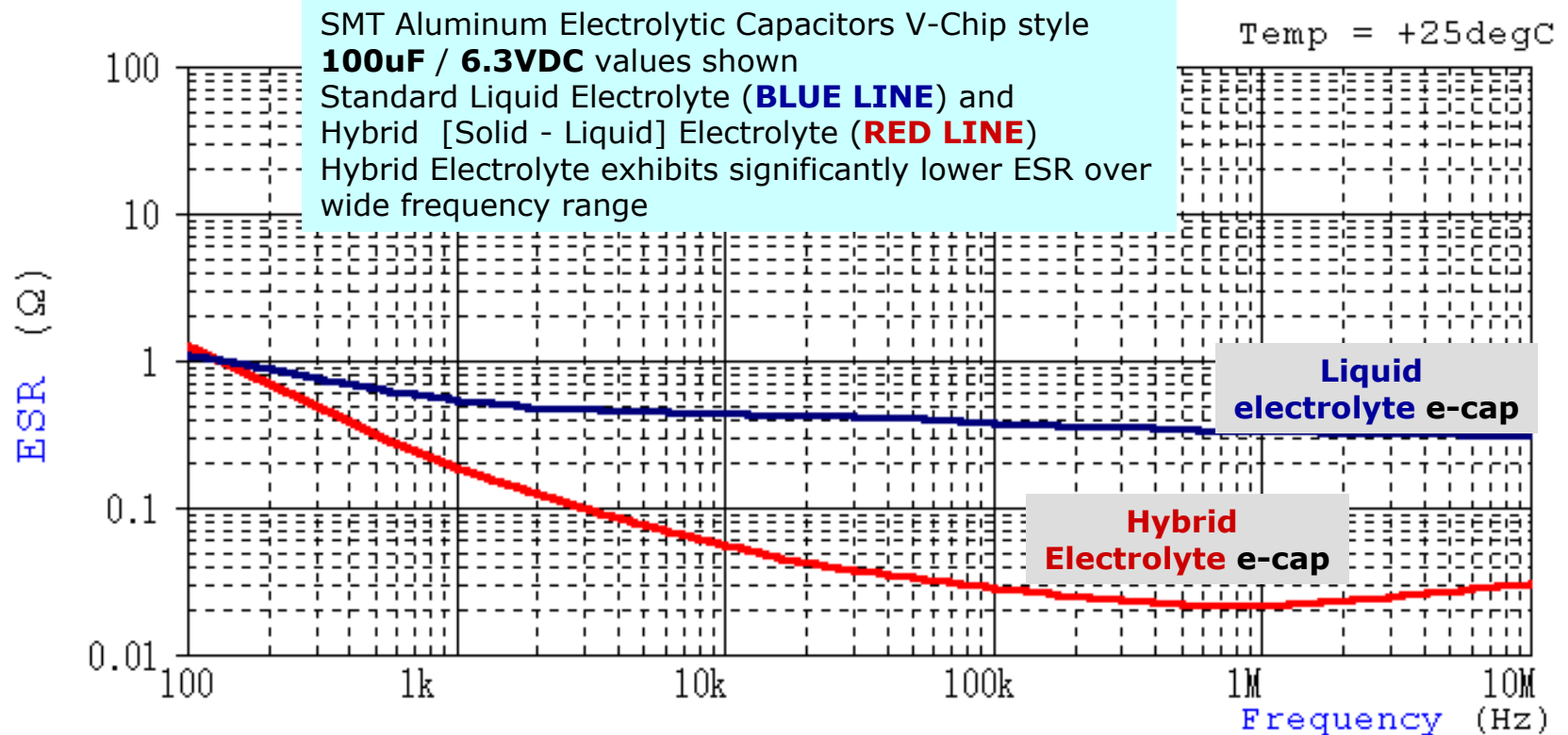
- [Lower ESR](#) & [Reduced Ripple Voltage](#) than standard LIQUID electrolyte e-caps
- [Improved performance](#) over temperature
- [Reduces number of components](#) required per board
- [Less PC Board Space used](#) & [Lower assembly costs](#)



**Technology:**  
Hybrid Electrolyte Aluminum Electrolytic Capacitors

**Features:**

- Improved ESR performance over **FREQUENCY** as compared to liquid electrolyte e-caps



**Hybrid Electrolyte E-caps = Lower ESR over frequency!**

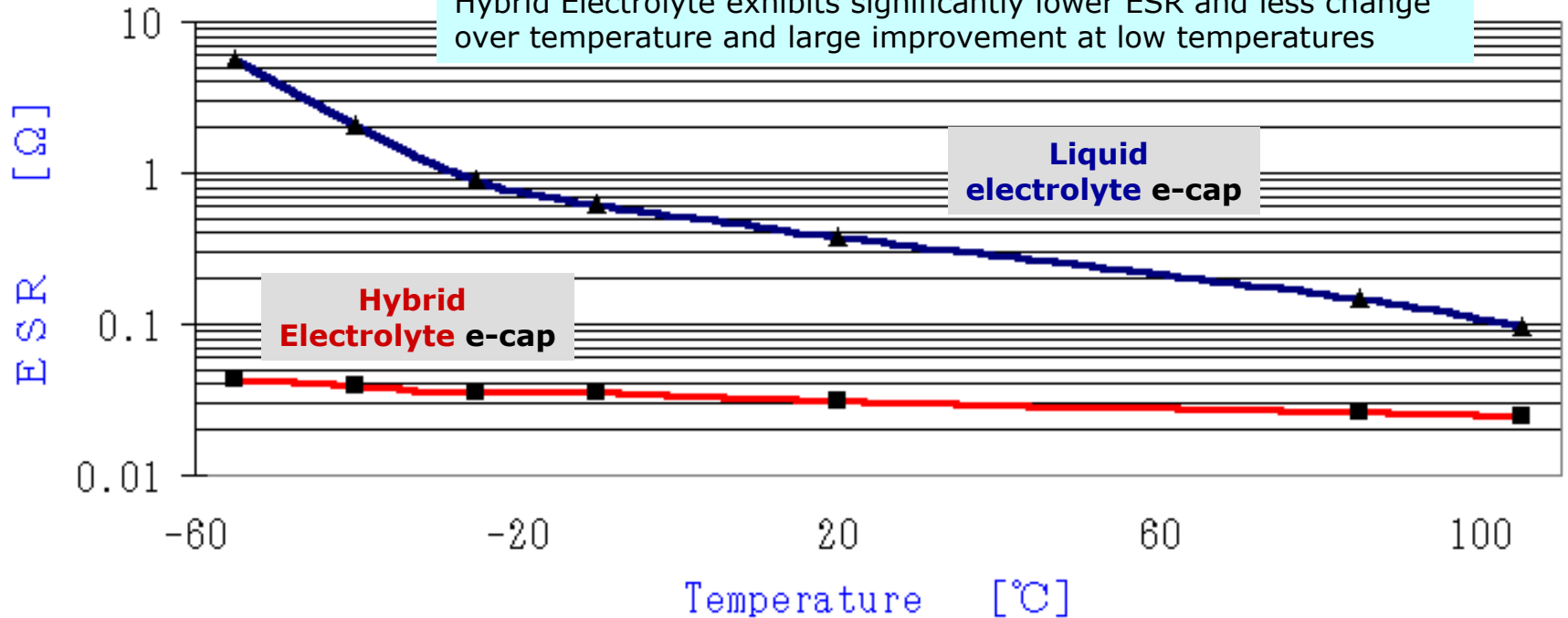
**Technology:**

Hybrid Electrolyte Aluminum Electrolytic Capacitors

**Features:**

- Improved ESR performance over TEMPERATURE as compared to liquid electrolyte e-caps

SMT Aluminum Electrolytic Capacitors V-Chip style  
**100uF / 6.3VDC** values shown  
Standard Liquid Electrolyte (**BLUE LINE**) and  
Hybrid [Solid - Liquid] Electrolyte (**RED LINE**)  
Hybrid Electrolyte exhibits significantly lower ESR and less change  
over temperature and large improvement at low temperatures



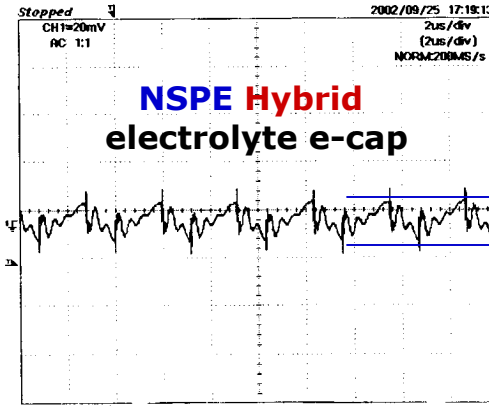
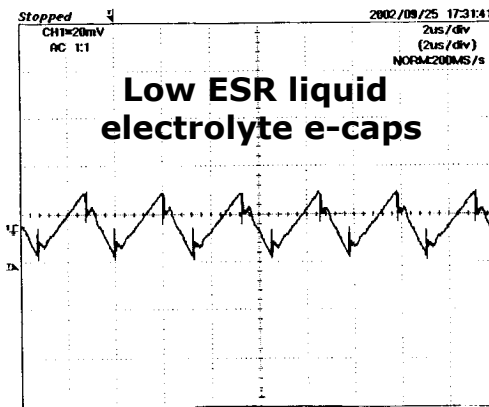
**Hybrid Electrolyte E-caps = Lower ESR over temperature!**

**Technology:**  
Hybrid Electrolyte Aluminum Electrolytic Capacitors

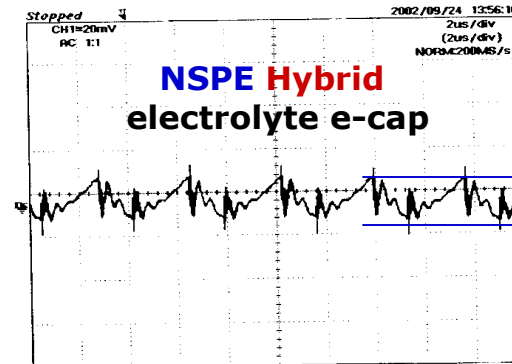
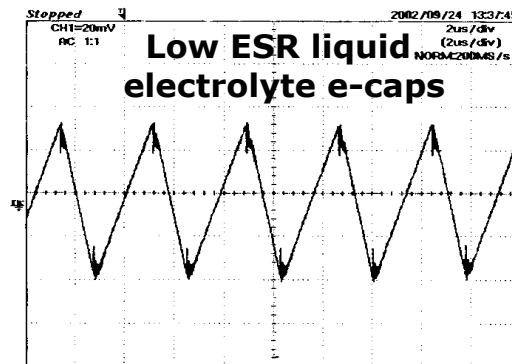
- Features:**
- Improved performance over temperature

**Application:** DC-DC Converter  
**Characteristic:** **Output Ripple Voltage**

Temperature: +25C



Temperature: -20C



**Hybrid Electrolyte E-caps = Lower ripple voltage over temperature!**

**Technology:**

Hybrid Electrolyte Aluminum Electrolytic Capacitors

**Features:**

- Reduces number of components required per board

**Application: DC-DC converter**  
Input voltage: 6VDC      Output voltage: 3.5VDC  
Ripple Current: 5A      Frequency: 250KHz



**8** x 330uF/ 10VDC

P/N: NACZ331M10V

**Low ESR liquid electrolyte e-cap**



**3** x 330uF/ 10VDC

P/N: **NSPE**331M10V

**Hybrid** electrolyte e-cap

**Technology:**

Hybrid Electrolyte Aluminum Electrolytic Capacitors

**Features:**

- Less PC Board Space used & Lower assembly costs



**8** parts ... PCB Area = 3600mm<sup>2</sup>



**3** parts ... PCB Area = 2275mm<sup>2</sup>

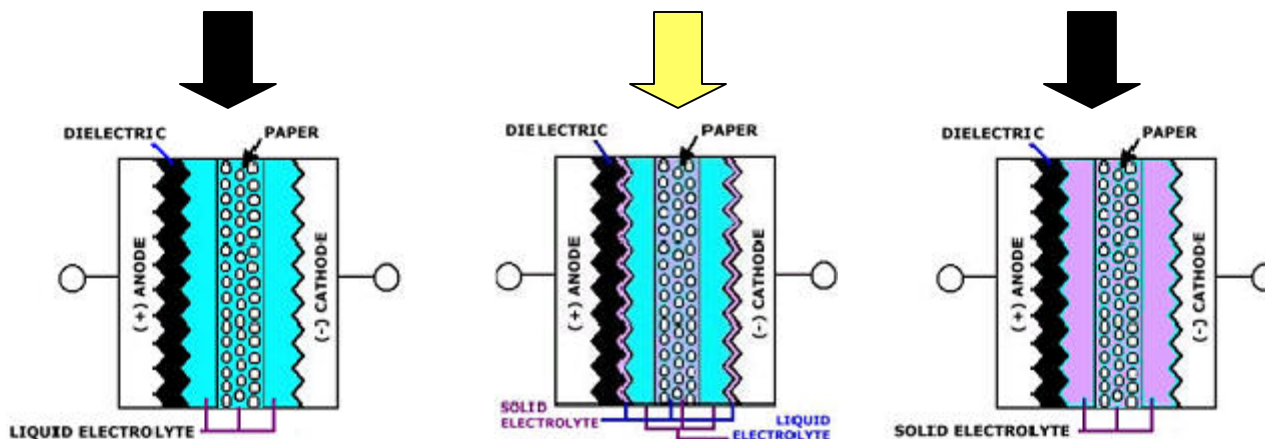
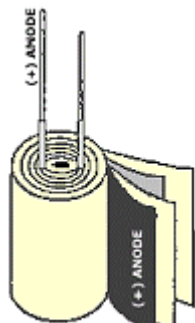
**PC Board space reduced by 40%!**

Reduced Assembly Costs: **Place 3 parts instead of 8!**

**Technology:**  
**Hybrid Electrolyte** Aluminum Electrolytic Capacitors  
**Comparison: Liquid – Hybrid – Solid Electrolytes**




| PROS & CONS  | Liquid Electrolyte  | Hybrid Electrolyte  | Solid Electrolyte  |
|--|---|---|--|
| <b>PROS</b>  | » Lowest Cost<br>» Moderately Low ESR<br>» Good Tolerance to<br>» Open Circuit Failure Mode | » Very Low ESR<br>» High RCR<br>» Stable Over Temperature<br>» Moderate Cost<br>» Good Tolerance to Transients<br>» Open Circuit Failure Mode | » Lowest ESR<br>» Highest RCR<br>» Stable Over<br>» Long Life, No Wear-Out |
| <b>CONS</b>  | » Limited Life @ High Temp<br>» Wear-Out<br>» Reduced performance at                        | » Limited Life @ High Temp<br>» Wear-Out  | » Highest Cost<br>» Limited Tolerance to<br>» Short Circuit Failure        |
| <b>Typical 100KHz ESR &amp; RCR</b>  | ESR = 0.39ohm MAX   | ESR = 0.050ohm MAX  | ESR = 0.039ohm MAX   |
| [ 100uF / 6VDC ]   | RCR = 0.25Arms MAX  | RCR = 1.12Arms MAX  | RCR = 2.50Arms MAX   |
| <b>ESR = Equivalent Series Resistance (ohm) RCR = Ripple (AC) Current Rating</b> |   |   |  |

**CONSTRUCTION**



**Technology Developments:**  
**Hybrid Electrolyte** Aluminum Electrolytic Capacitors

**Further reduction in ESR** (Due February 2004)

|                  | <b>Current Specifications</b> |   | <b>Feb-04</b>                |
|------------------|-------------------------------|---|------------------------------|
| <b>CASE SIZE</b> | <b>100KHz ESR (ohm) MAX.</b>  |   | <b>100KHz ESR (ohm) MAX.</b> |
| <b>6.3x6</b>     | 0.050                         |  | 0.025                        |
| <b>8x10.5</b>    | 0.030                         |  | 0.015                        |
| <b>10x10.5</b>   | 0.025                         |  | 0.013                        |

**Reduction in Case Sizes** (Due January 2004)

| <b>Current Sizes</b> | <b>Next Generation Sizes</b> |
|----------------------|------------------------------|
| <b>6.3x6.0</b>       | 5x4.5                        |
| <b>8x10.5</b>        | 5x5.4                        |
| <b>10x10.5</b>       | 5x6.0                        |
|                      | 6.3x5.4                      |
|                      | 6.3x4.5                      |
|                      | 6.3x7.7                      |
|                      | 8 x7.7                       |
|                      | 10x7.7                       |

**Technology Developments:**

**Hybrid Electrolyte** Aluminum Electrolytic Capacitors

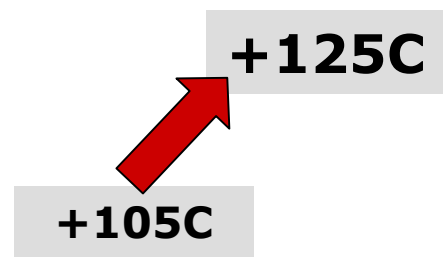
**Extended Temperature Rating / Longer Life:**

**NSPEW** = +125C rating

**Load Life = 1500 hours @ +125C ... 6000 hrs @ +105C**

Applications: Automotive, Telecom, Servers, etc.

[ Due February 2004 ]

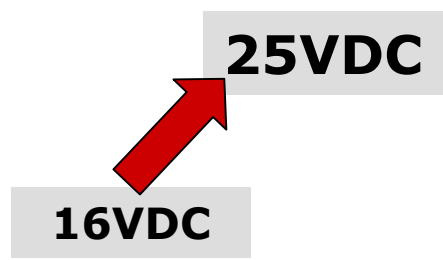


**Increased Voltage Rating:**

**25VDC** Working Voltage Rating

**NSPE Series**

[Due January 2004 ]



## Hybrid Electrolyte Aluminum Electrolytic Capacitors

### **NSPE Series – Surface Mount**

**Capacitance Values:** 22 ~ 820uF

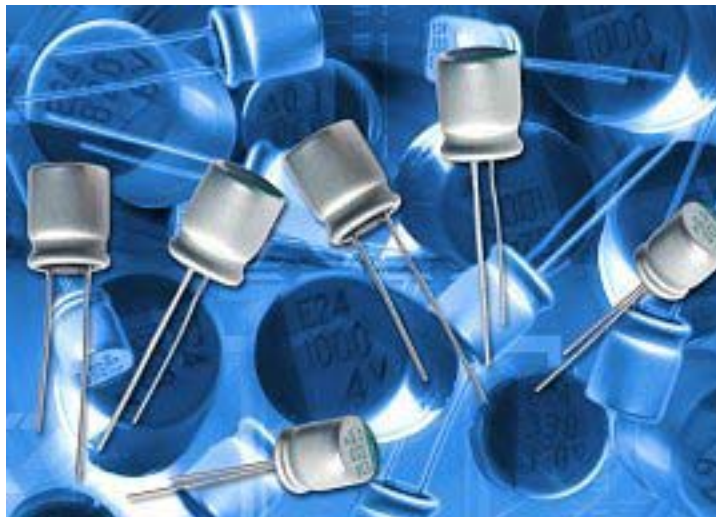
**Voltage Ratings:** 4 ~ 16VDC

**Sizes:** 6.3, 8 & 10mm Dia

**100KHz ESR:** 0.025 ohm

**100KHz RCR:** 2.18Arms

 [Data Sheet](#) | [Request A Sample](#)



### **NSPER Series – Radial LDD**

**Capacitance Values:** 330 ~ 1000uF

**Voltage Ratings:** 4 ~ 10VDC

**Sizes:** 8 & 10mm Diameters

**100KHz ESR:** 0.012 ohm

**100KHz RCR:** 2.34Arms

 [Data sheet](#) | [Request A Sample](#)