



Hybrid Construction Aluminum Electrolytic Capacitors



Advantages:

Lower ESR ($\geq 0.015\Omega$) @ **Higher VDC**; 25V, 35V, 40V, 50V, 63V, 80V & 100VDC

Safer: Excellent Inrush Current Characteristics & Open Mode Failure

> **20X improvement** at Low Temperatures

Reduce component count & PCB real-estate

→ Samples [[In Stock](#)] ←

Technical Support



Live Chat Help
www.NICcomp.com

Questions relating to the following information

- or - requests to schedule technical seminars on this information should be directed to:

Jim Wight, VP Technology Jim.wright@niccomp.com 631-396-7500

SMT **V-Chip** Format



NSPE-x Series

Hybrid Construction SMT Aluminum Electrolytic Capacitors

Target:

Requirements not covered by solid polymer capacitors, liquid electrolyte capacitors and MLCC capacitors

Hybrid Advantage:

- Availability of high voltage ratings (35VDC, 40VDC, 50VDC, 63VDC, 80VDC & 100VDC)
- Ability to handle transient events without failing (Excellent inrush current characteristics)
- Failure mode is open mode (solid polymer capacitor failure mode is typically short mode)
- Much lower ESR and RCR than liquid construction aluminum electrolytic capacitors
- Much lower ESR & Z at low temperature than liquid construction aluminum electrolytic capacitors

Target Markets (PCB level):

- Power supply - conversion – management
- Automotive & Transportation
- Telecommunications - Data communications
- Outdoor use applications for which high reliability (and long lifetime) is required

SMT V-Chip Format



NSPE-x Series

Hybrid Construction SMT Aluminum Electrolytic Capacitors

Circuit Application Requirements:

- Higher VDC circuit applications where low ESR & High RCR is required
- Low temperature (outdoor) end use applications, where hybrid has characteristics advantage
- Need high reflow soldering heat ratings (+260°C)
- Ability to handle transient events without failing

Target Circuits:

- Boost Converters (step-up converter)
- SEPIC Converters
- 24VDC, 36VDC, 42VDC & 48VDC Power
- Backplane Power (42VDC)
- PoE – Power Over Ethernet (≤57VDC)
- Phantom Power (48VDC)
- Hot-Swap Controllers
- POL - Point Of Load Converters
- SMPS - Switched Mode & Linear Power Supplies

Co-sell With:

- Step-Up (Boost) Regulators
- Switching Regulator ICs
- Controller ICs
- SEPIC Regulators
- Flyback Regulators
- MOSFETs
- Power FETs
- Linear Regulators
- NIC Power Inductors: NPI, NPIS & NPIM ([link](#))
- NIC Current Sensing Resistors: NCSx ([link](#))





NSPE series

- ➔ Increased VDC rated (up to **100VDC**)
- ➔ Temperature ratings **+125°C & +135°C**
- ➔ Low ESR & High RCR

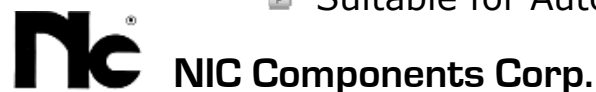


SMT **V-chip** Format

Series	Temp Range	Life Rate @ Max Temp	Voltage Rating	Capacitance Range	100KHz ESR	100Hz RCR @ Max Temp	Reflow Limit
NSPE-S	-55°C ~ +105°C	3K & 5KHrs	6.3 ~ 16VDC	10 ~ 1000uF	≥0.015Ω	≤3.89A	+250°C
NSPE-H	-55°C ~ +105°C	5K & 10KHrs	25 ~ 100VDC	2.7 ~ 270uF	≥0.022Ω	≤2.53A	+260°C
NSPE-T	-55°C ~ +125°C	2K & 3KHrs	25 ~ 100VDC	3.9 ~ 270uF	≥0.022Ω	≤1.52A	+260°C
NSPE-U	-55°C ~ +125°C	2KHrs	6.3 ~ 16VDC	22 ~ 560uF	≥0.016Ω	≤2.19A	+250°C
NSPE-Y	-55°C ~ +135°C	2KHrs	25 ~ 63VDC	22 ~ 270uF	≥0.016Ω	≤2.19A	+250°C

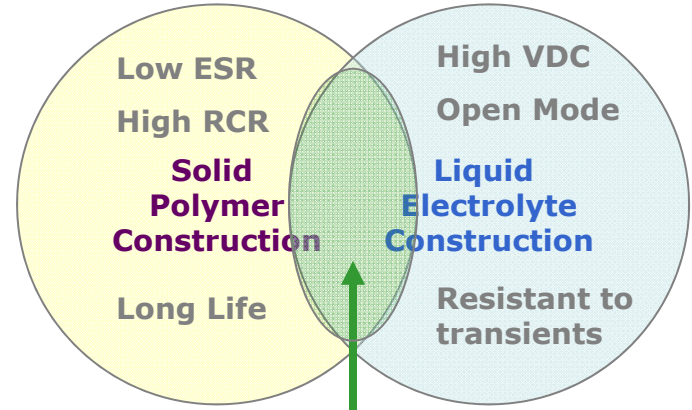
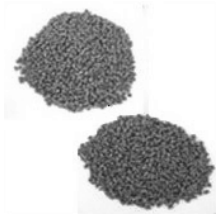
FEATURES:

- ▶ Ultra-Low ESR (≥0.015Ω)
- ▶ High Ripple Current Rating RCR to ≤3.9Arms (+105°C)
- ▶ Extended Temperatures to +125°C & +135°C
- ▶ Lifetime Ratings: 3000 ~10,000 hours (+105°C)
- ▶ Wide Voltage Range: 6.3VDC –100VDC
- ▶ Wide Capacitance Range: 10uF – 1000uF
- ▶ Suitable for Automotive equipment applications [TS-16949 site]





Hybrid Alum E-caps / NSPE series



Hybrid Construction
Using solid polymer and liquid electrolyte can offer advantages of both technologies

Use NPSE-x Series to Cross and Replace these **Solid Polymer** Type **V-Chip** Alum E-caps:

Competition Series

- Nichicon **CF, CJ, CG**
- United Chemicon **PXS, PXF, PXE, PXA, PXH**
- Sanyo **OS-CON (SVP, SVPF, SVQP & SVPD)**



SMT V-Chip Format

PERFORMANCE COMPARISON
Example: 470uF, 6.3VDC, 10x10.5mm

SOLID "N" Type (example)	RCR = 4600mA, ESR = 0.016Ω
HYBRID NIC NSPE-S series:	RCR = 3650mA, ESR = 0.016Ω
LIQUID NIC NAZV series:	RCR = 850mA, ESR = 0.160Ω



Comparison of Construction Types: Liquid - Hybrid - Solid Electrolyte

PROS & CONS	Liquid Electrolyte	Hybrid Electrolyte	Solid Electrolyte
PROS	<ul style="list-style-type: none"> » Lowest Cost » Moderately Low ESR » Good Tolerance to Transients » Open Circuit Failure Mode 	<ul style="list-style-type: none"> » Very Low ESR » High RCR » Stable Over Temperature » Moderate Cost » Good Tolerance to Transients » Open Circuit Failure Mode 	<ul style="list-style-type: none"> » Lowest ESR » Highest RCR » Stable Over Temperature » Long Life, No Wear-Out
CONS	<ul style="list-style-type: none"> » Limited Life @ High Temp » Wear-Out » Reduced performance at Low Temperature 	<ul style="list-style-type: none"> » Limited Life @ High Temp » Wear-Out 	<ul style="list-style-type: none"> » Highest Cost » Limited Tolerance to Transients » Short Circuit Failure Mode
CONSTRUCTION			

ESR = Equivalent Series Resistance (ohm) RCR = Ripple (AC) Current Rating

Hybrid Construction
Using solid polymer and liquid electrolyte construction, has advantages of both technologies



Hybrid Alum E-caps / NSPE series

Hybrid Capacitor Road Map / 2010 – 2011

NSPE-H (+105°C, 10,000 hrs)

NSPE-T (+125°C, 100VDC)

NSPE-Y (+135°C, 63VDC)

→ **New case size 10x12.5mm** [Specifications & Samples pending]

NSPE-H (+105°C, 10,000 hrs)

NSPE-T (+125°C, 100VDC)

→ **Expanded capacitance** [Specifications & Samples pending]

NSPE-H (+105°C, _____ hrs)

→ **Low Profile Size: 6.3x4.8mm** [Specifications & Samples pending]



1000uF @ 6.3V & 10VDC
10 x 10.5mm

EVOLUTION:
Extending Lifetime
Lower ESR
Increased RCR
Higher Reflow Rating

+260°C Reflow
HYBRID

10X10.8
1000µF @ **6.3VDC**
100KHz ESR = **15mΩ**
100KHz ESR = **3890mA**
Life @ +105C = 5KHrs
Life @ +85C = 20KHrs

Higher Reflow
+105°C
Low ESR

NSPE

NAZT

NAZK

NAZJ

+235°C Reflow
+105°C
Low ESR

NACK

10x10.5TR13F
1000µF @ 10VDC
100KHz ESR = **80mΩ**
100KHz ESR = **850mA**
Life @ +105C = 2KHrs
Life @ +85C = **8KHrs**
10x10.5TR13**EF**
Life @ +105C = **5KHrs**
Life @ +85C = **20KHrs**

+240°C Reflow
+105°C
Low ESR

NACZ

10X10.5
1000µF @ 10VDC
100KHz ESR = **90mΩ**
100KHz RCR = **670mA**
Life @ +105C = 2KHrs
Life @ +85C = **8KHrs**

+240°C Reflow
+105°C

NACEW

10X10.5
1000µF @ 10VDC
120Hz ESR = 0.398Ω
120Hz RCR = 310mA
Life @ +105C = 2KHrs
Life @ +85C = **8KHrs**

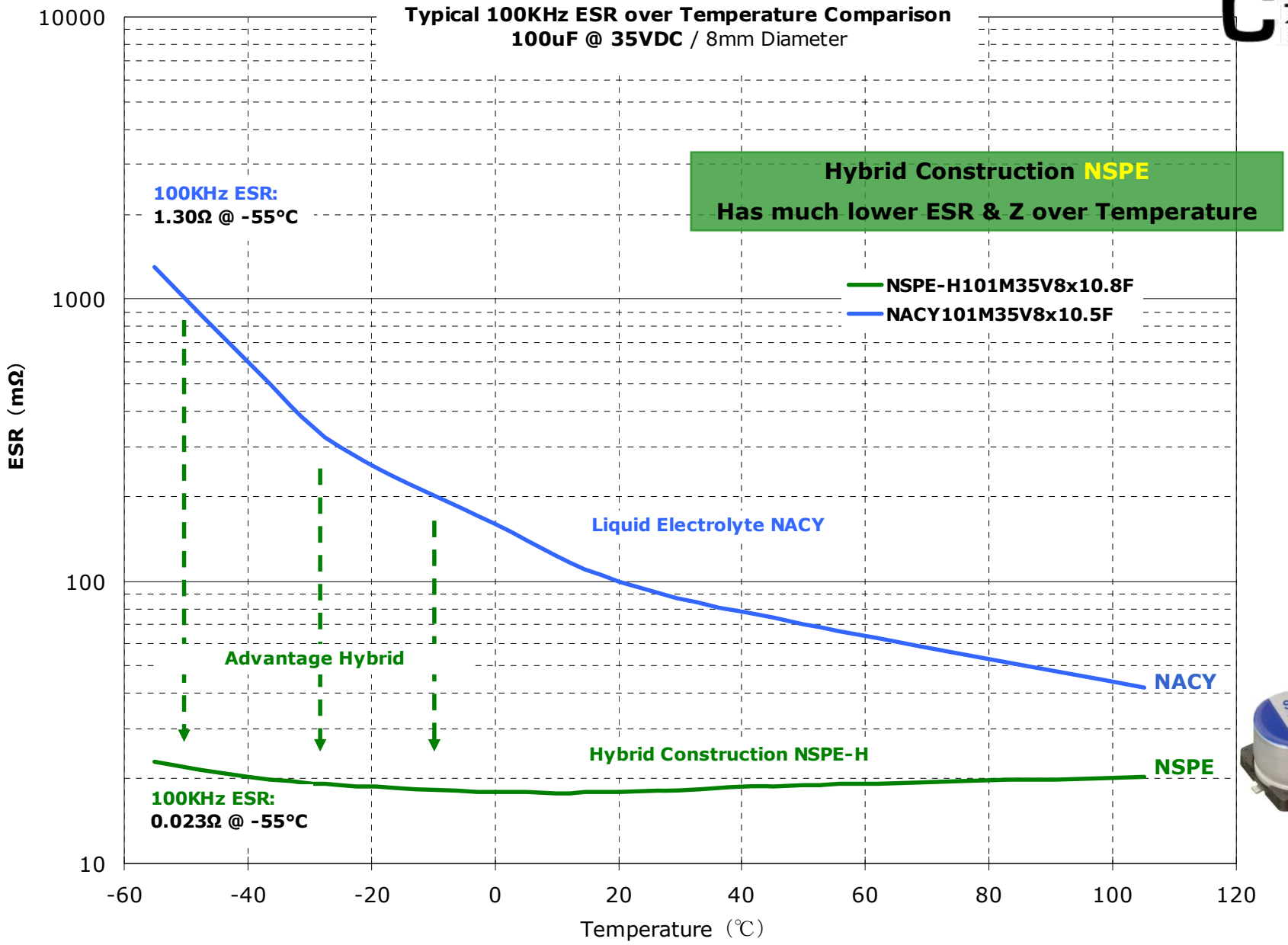
+240°C Reflow
+85°C

NACE

10X10.5
1000µF @ 10VDC
120Hz ESR = 0.398Ω
120Hz RSR = 450mA
Life @ +85C = **2KHrs**

Increased Reflow Rated	100KHz ESR	100KHz RCR	Life at 105C	Life at 85C
NAZJ102M10V10X10.5 K BF	60mΩ	1190mA	2KHrs	8KHrs
NAZK102M10V10X10.5 L BF	80mΩ	850mA	2KHrs	8KHrs
NAZT102M10V10X10.5 L BF	90mΩ	670mA	5KHrs	20KHrs

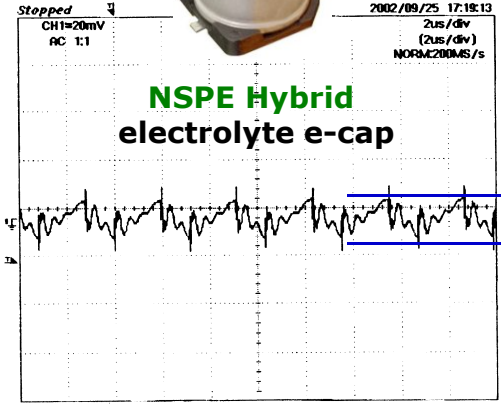
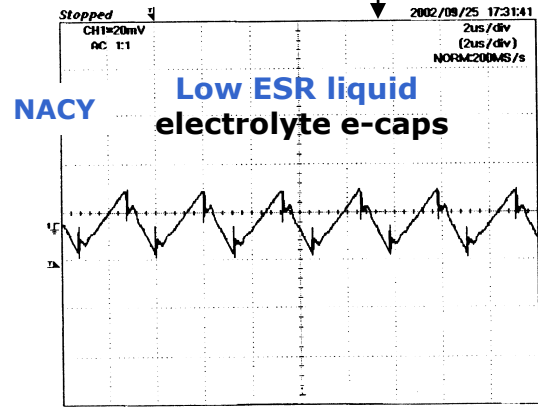
K = +245°C Reflow
L = +250°C Reflow



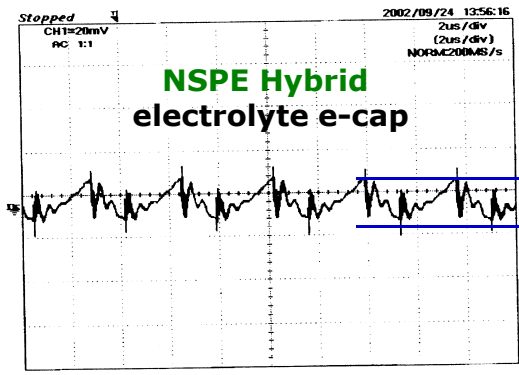
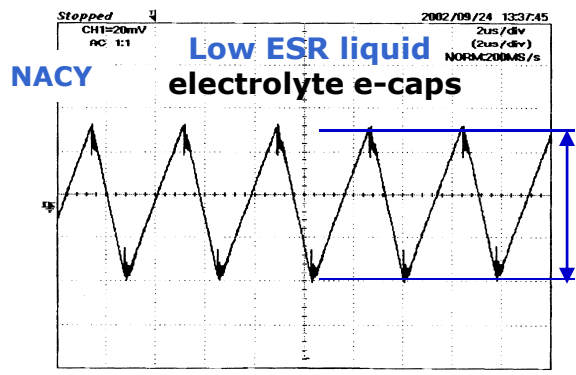


Application: DC-DC Converter
Characteristic: Output Ripple Voltage

Temperature: +25C



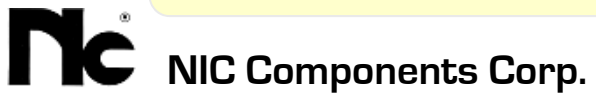
Temperature: -20°C



Hybrid Electrolyte E-caps = Lower ripple voltage at low temperature

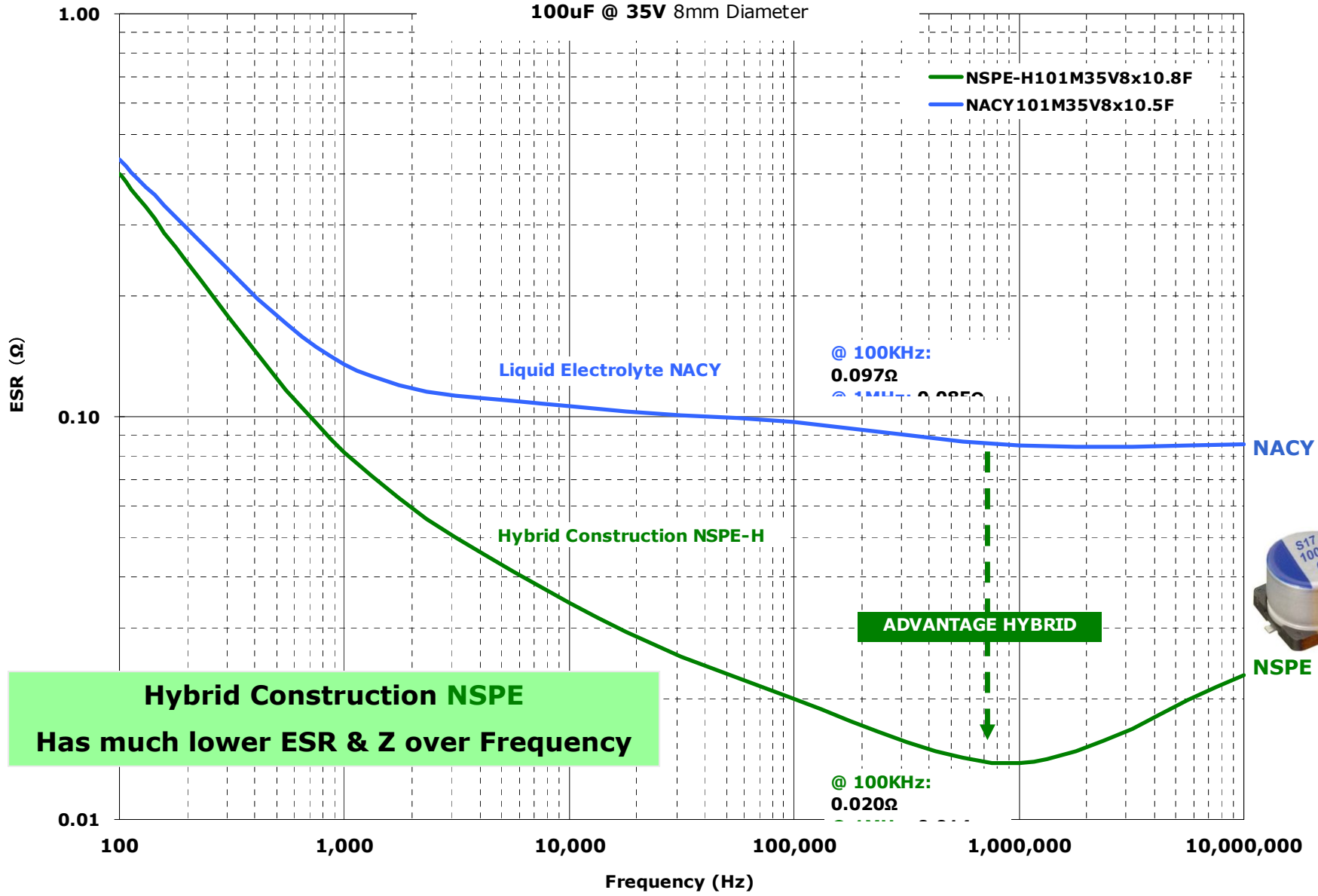
Liquid Construction **NACY**
Poor Performance at Low Temperature

Hybrid Construction **NSPE**
Much lower ESR & Z over Temperature

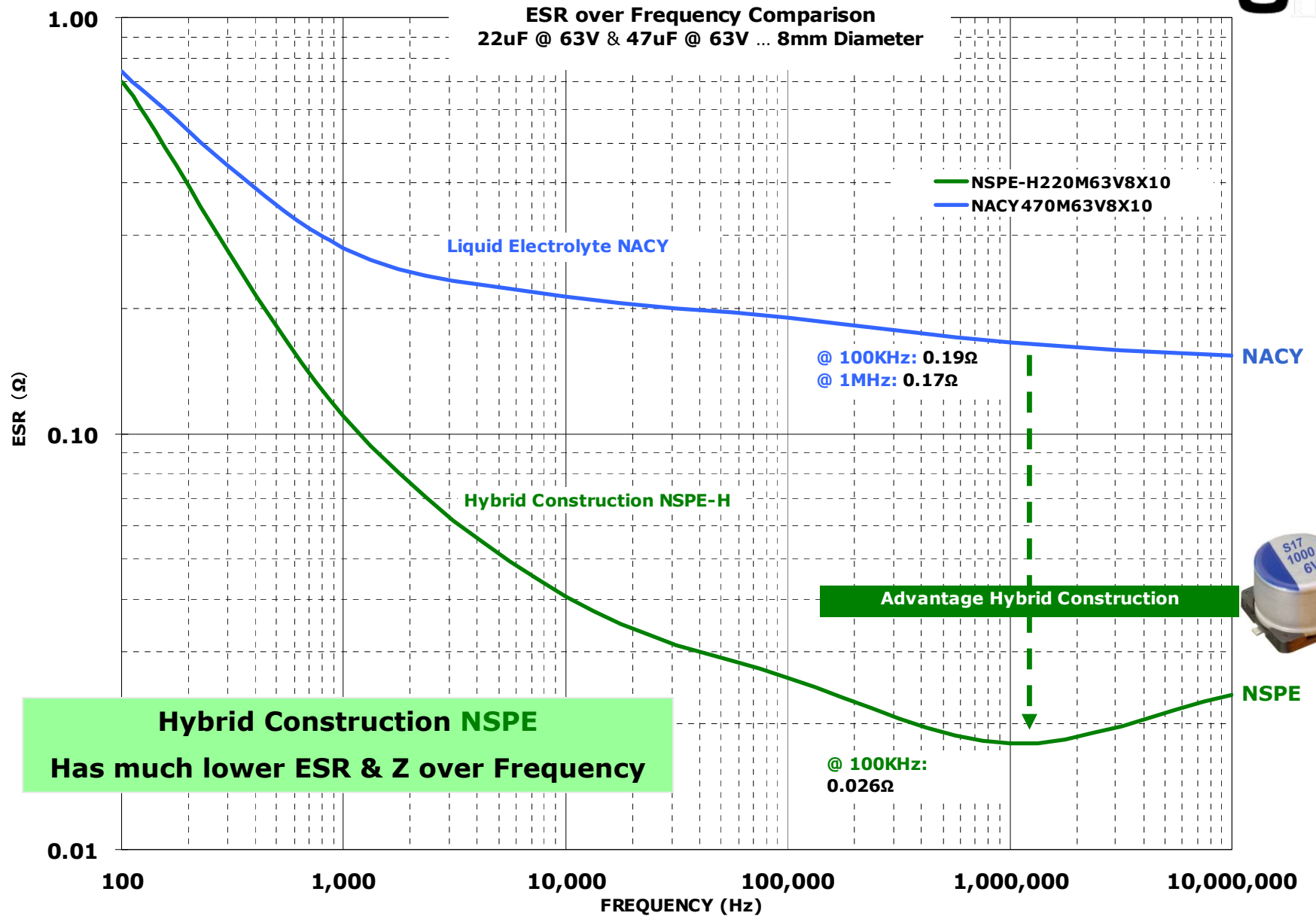




ESR over Frequency Comparison
100uF @ 35V 8mm Diameter



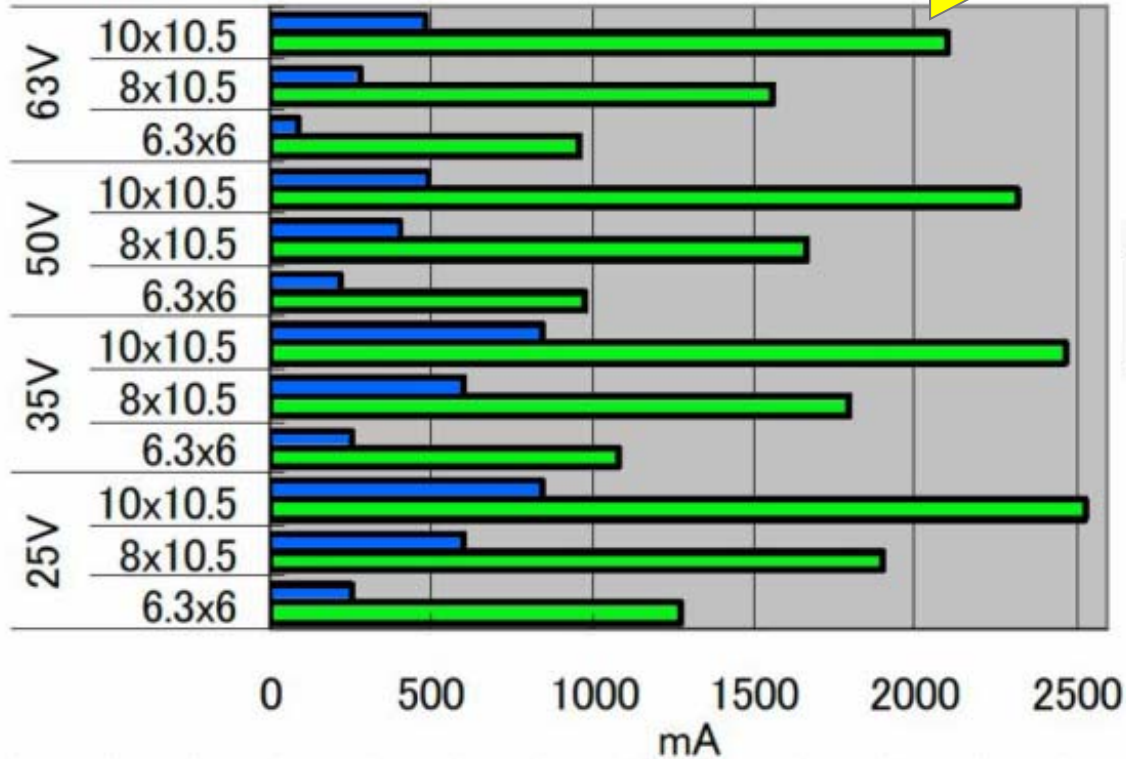
NSPE





Ripple Current Rating (RCR) Comparison: Liquid to Hybrid Construction

RCR: Higher is Better

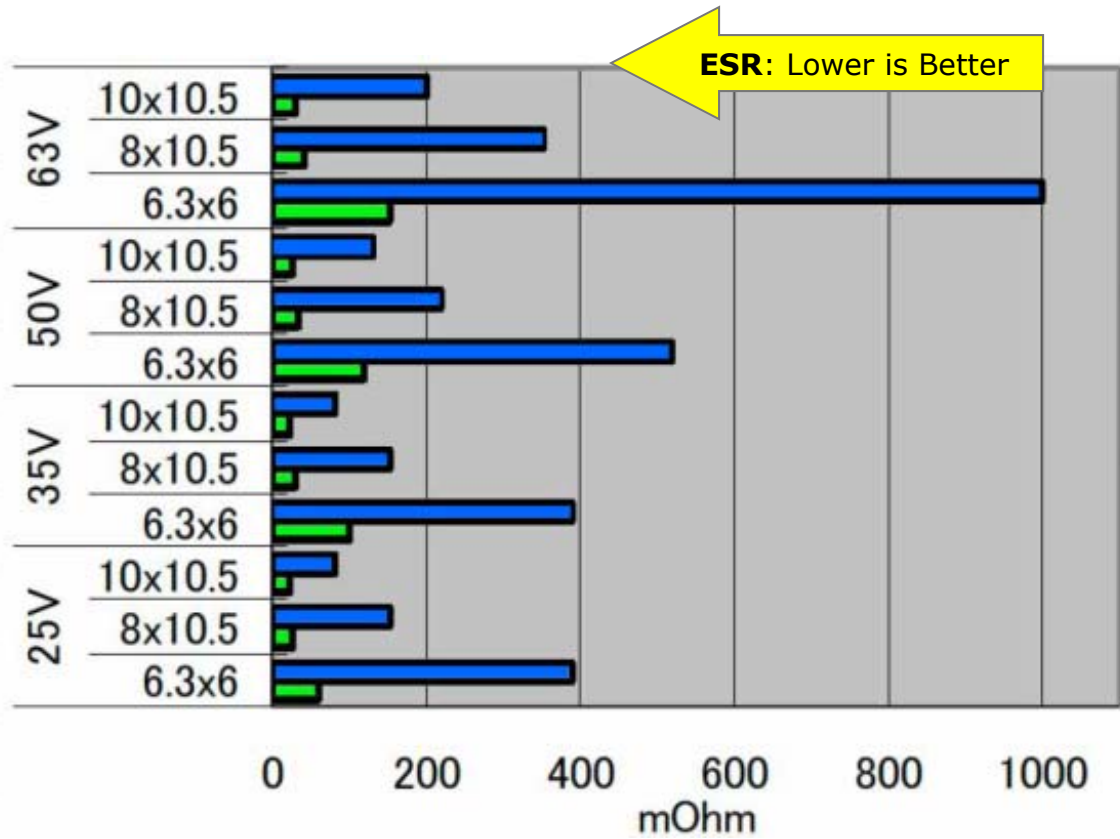


Hybrid Advantage
Much Higher Current Rating

NACY
NSPE-H



Equivalent Series Resistance (ESR) Comparison: Liquid to Hybrid Construction





Hybrid Advantage
Much Lower ESR

NACY
NSPE-H



Comparison: Liquid to Hybrid Construction

Series / Type	NACY / Liquid	NSPE-H / Hybrid
Case Size	12.5mm X 14mm	6.3mm X 8mm
100KHz ESR	0.100 Ω	0.080 Ω
100KHz RCR	800mArms	1200mArms
Life Rating @ +105°C	2000 hours	5000 hours
WVDC	50VDC	50VDC
Capacitance	330uF	10uF
NIC PN	NACY331M50V12.5X14	NSPE-H100M50V6.3X8
SMT Format	 <p>12.5mm Diameter 14mm Height</p>	 <p>6.3mm Diameter 8mm Height</p>

Hybrid Advantages

Much Smaller Size & Lower Profile


Lower ESR

Higher Current Rating

Longer Life



Comparison: Liquid to Hybrid Construction

Series / Type	NACY / Liquid	NSPE-H / Hybrid
Case Size	16mm X 17mm	8mm X 10.8mm
100KHz ESR	0.060 Ω	0.035 Ω
100KHz RCR	1610mArms	1670mArms
Life Rating @ +105°C	2000 hours	10,000 hours
WVDC	50VDC	50VDC
Capacitance	1000uF	33uF
NIC PN	NACY102M50V16X17	NSPE-H330M50V8X10.8
SMT Format	 <p>16mm Diameter 17mm Height</p>	 <p>8mm Diameter 11mm Height</p>

Hybrid Advantages

Much Smaller Size & Lower Profile

Lower ESR

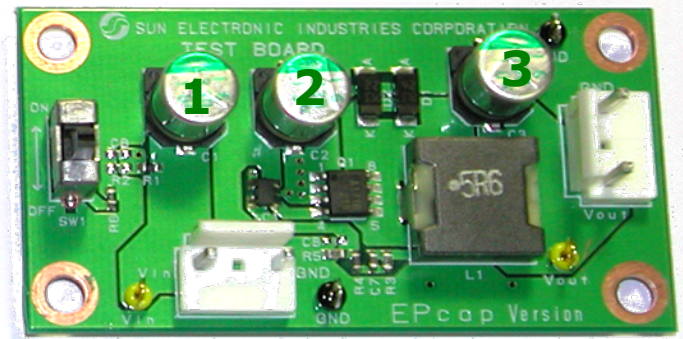
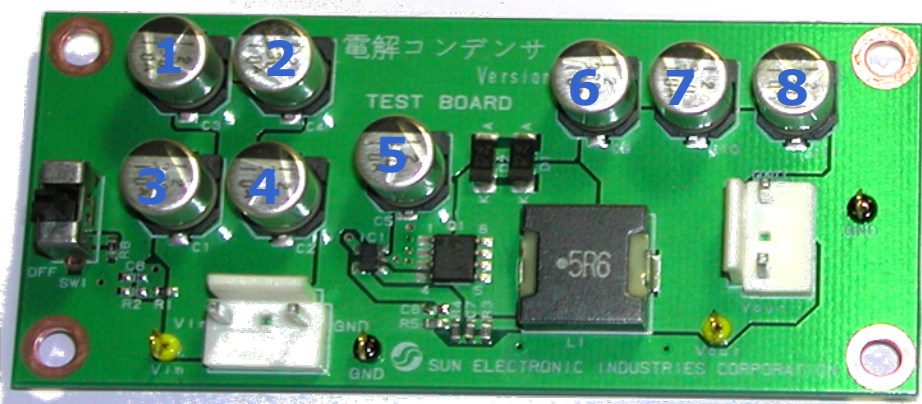
Higher Current Rating

Much Longer Life



Comparison: Liquid to Hybrid Construction

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: NSPE331M10V
Hybrid electrolyte e-cap

Hybrid Advantages
Reduce Number of Components per PCB

Replace **Solid Polymer** Aluminum Electrolytic Capacitors



SMT Solid Polymer Aluminum E-Caps



Capacitor Types: Hybrid and Polymer			NIC	Sanyo	Nichicon	NCC
SMT	105°C	6 ~ 16VDC	NSPE-S	SVP	CF	PXA
SMT	105°C	≥25VDC	NSPE-H	SVPF	CV	PXA
SMT	125°C	6 ~ 16VDC	NSPE-U	SVQP		PXH
SMT	125°C	≥25VDC	NSPE-T	SVPD		PXH

SANYO

OS-CON

nichicon



NIPPON CHEMI-CON CORPORATION



Samples In Quick Kit Stock For Immediate Shipment

NIC Part Number	Description	Case Size	Capacitance	Voltage (VDC)	100KHz ESR	100KHz RCR
NSPE-S221M6.3V8X10.8TR13F	Hybrid Alum. E-Cap	8x10.8	220 μ F	6.3V	16mΩ	3150mA
NSPE-S471M6.3V8X10.8TR13F	Hybrid Alum. E-Cap	8x10.8	470 μ F	6.3V	16mΩ	3150mA
NSPE-S331M10V8X10.8TR13F	Hybrid Alum. E-Cap	8x10.8	330 μ F	10V	18mΩ	2800mA
NSPE-U221M10V8X10.8LBF	Hybrid Extended Temp.	8x10.8	220 μ F	10V	18mΩ	1680mA
NSPE-U101M16V10X10.8LBF	Hybrid Ultra Low ESR	10x10.8	100 μ F	16V	19mΩ	1850mA
NSPE-S151M16V10X10.8TR13F	Hybrid Alum. E-Cap	10x10.8	150 μ F	16V	20mΩ	2920mA
NSPE-S101M16V8X10.8TR13F	Hybrid Alum. E-Cap	8x10.8	100 μ F	16V	22mΩ	2290mA
NSPE-H151M35V10X10.8NBYF	Hybrid High Voltage	10x10.8	150μF	35V	23mΩ	2470mA
NSPE-T101M35V8X10.8NBYF	Hybrid Extended Temp.	8x10.8	100μF	35V	30m Ω	1260mA
NSPE-T330M63V10X10.8NBYF	Hybrid Extended Temp.	10x10.8	33μF	63V	30m Ω	1260mA
NSPE-H220M63V8X10.8NBYF	Hybrid High Voltage	8x10.8	22μF	63V	40m Ω	1560mA
NSPE-S330M16V6.3X6.3TR13F	Hybrid Alum. E-Cap	6.3x6.3	33μF	16V	54m Ω	1130mA
NSPE-H470M25V6.3X6.3NBYF	Hybrid High Voltage	6.3x6.3	47μF	25V	60m Ω	1270mA
NSPE-H470M35V6.3X8NBYF	Hybrid High Voltage	6.3x8	47μF	35V	60m Ω	1300mA
NSPE-T100M50V6.3X8NBYF	Hybrid Extended Temp.	6.3x8	10μF	50V	80m Ω	840mA

→ www.niccomp.com/quick_kits/gk.asp?category=capacitors&str=lowESR ←

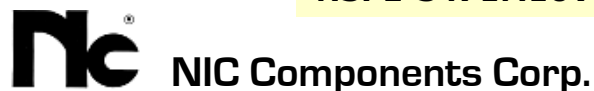


End Use Application Requirements by Capacitance, VDC & Size

NSPE-S Designs

Application - End Market	Part Number	Cap	Voltage	Size
RF Modules	NSPE-S101M6.3V6.3X6.3TR13F	100uF	6.3VDC	6.3x6.3
PC Cards	NSPE-S101M6.3V6.3X6.3TR13F	100uF	6.3VDC	6.3x6.3
Smart Meters	NSPE-S101M6.3V6.3X6.3TR13F	100uF	6.3VDC	6.3x6.3
PBX Converter (VOIP)	NSPE-S331M6.3V8X10.8TR13F	330uF	6.3VDC	8x10.8
Point of Load	NSPE-S391M6.3V8X10.8TR13F	390uF	6.3VDC	8x10.8
WIMAX Base Station	NSPE-S391M6.3V8X10.8TR13F	390uF	6.3VDC	8x10.8
GPS	NSPE-S471M6.3V10X10.8TR13F	470uF	6.3VDC	10x10.8
Server	NSPE-S471M6.3V10X10.8TR13F	470uF	6.3VDC	10x10.8
Gaming Machines	NSPE-S101M10V8X10.8TR13F	100uF	10VDC	8x10.8
Graphic Card	NSPE-S221M10V8X10.8TR13F	220uF	10VDC	8x10.8
Power Supply	NSPE-S221M10V8X10.8TR13F	220uF	10VDC	8x10.8
Home Automation	NSPE-S221M10V8X10.8TR13F	220uF	10VDC	8x10.8
Communicator	NSPE-S331M10V8X10.8TR13F	330uF	10VDC	8x10.8
Routers / Networking	NSPE-S331M10V8X10.8TR13F	330uF	10VDC	8x10.8
Telecommunication	NSPE-S331M10V8X10.8TR13F	330uF	10VDC	8x10.8
WIMAX Base Station	NSPE-S331M10V8X10.8TR13F	330uF	10VDC	8x10.8
POS Equipment	NSPE-S470M10V6.3X6.3TR13F	47uF	10VDC	6.3x6.3
Wireless Gateway	NSPE-S471M10V10X10.8TR13F	470uF	10VDC	10x10.8
Point of Load	NSPE-S471M10V10X10.8TR13F	470uF	10VDC	10x10.8
WIMAX Base Station	NSPE-S471M10V10X10.8TR13F	470uF	10VDC	10x10.8
Power Supply Equipment	NSPE-S471M10V10X10.8TR13F	470uF	10VDC	10x10.8
Gaming Machines	NSPE-S471M10V10X10.8TR13F	470uF	10VDC	10x10.8

NSPE-S471M10V10X10.8TR13F / Adding to **Quick Kit Program** September 2010



End Use Application Requirements by Capacitance & VDC

NSPE-S Designs

Application	Part number	Capacitance	Voltage
LED light	NSPE-S101M6.3V6.3X6.3TR13F	100uF	6.3VDC
Power Meter	NSPE-S101M6.3V6.3X6.3TR13F	100uF	6.3VDC
Electricity Meter	NSPE-S101M6.3V6.3X6.3TR13F	100uF	6.3VDC
Marine satellite communication	NPSE-S151M6.3V6.3X6.3TR13F	150uF	6.3VDC
Storage Equipment	NSPE-S151M6.3V6.3X6.3TR13F	150uF	6.3VDC
Storage Equipment	NSPE-S331M6.3V8X10.8TR13F	330uF	6.3VDC
LED light	NSPE-S561M6.3V8X10.8TR13F	560uF	6.3VDC
Gaming machines	NSPE-S101M10V8X10.8TR13F	100uF	10VDC
Wireless Broadband	NSPE-S331M10V8X10.8TR13F	330uF	10VDC
Digital Video Distribution System	NSPE-S471M10V10X10.8TR13F	470uF	10VDC
Gaming machines	NSPE-S471M10V10X10.8TR13F	470uF	10VDC
Wireless Broadband	NSPE-S471M10V10X10.8TR13F	470uF	10VDC
TV systems / set top box	NSPE-S471M10V10X10.8TR13F	470uF	10VDC
Gaming machines	NSPE-S101M16V8X10.8TR13F	100uF	16VDC
Storage Equipment	NSPE-S151M16V10X10.8TR13F	150uF	16VDC

NSPE-S471M10V10X10.8TR13F / Adding to **Quick Kit Program** September 2010

End Use Application Requirements by Capacitance & VDC

NSPE-H Designs

Industry	Application	Capacitance	Voltage
LED TV	Backlight Inverter	68uF	25VDC
Automotive	Multimedia	150uF	25VDC
Automotive	LED lighting	270uF	25VDC
Automotive	Electronic parking brake system	270uF	25VDC
Automotive	Diesel Engine Control Unit	47uF	35VDC
PC	Charger for laptop	47uF	35VDC
AV	Video Camera for Pro	47uF	35VDC
Automotive	Fuel System Control	100uF	35VDC
Automotive	RF-Hub	100uF	35VDC
Automotive	Wiper	150uF	35VDC
Automotive	Hybrid Car	150uF	35VDC
Automotive	Diesel Engine Control Unit	150uF	35VDC
Automotive	Fuel System Control	150uF	35VDC
Server	Cooling Fan	150uF	35VDC
Security & Alarm	Security Camera	150uF	35VDC
AV	Video Camera for Pro	150uF	35VDC
LED TV	Backlight Inverter	10uF	50VDC
Automotive	Fuel System Control	56uF	50VDC
Security & Alarm	Security Camera	3.9uF	63VDC
LED TV	Backlight inverter	33uF	63VDC
Industrial Controls	Motor Control	12uF	80VDC

Note : Most popular item for all industries = **NSPE-H** 150uF @ 35VDC

End Use Application Requirements by Capacitance, VDC & Size

NSPE-H Designs

Part number	Application	Capacitance	Voltage	Case Size
NSPE-H470M25V6.3X6.3NBYF	Wireless Switching	47uF	25VDC	6.3X6.3
NSPE-H151M25V8X10.8NBYF	IP Handset	150uF	25VDC	8x10.8
NSPE-H151M25V8X10.8NBYF	DSLAM	150uF	25VDC	8x10.8
NSPE-H151M25V8X10.8NBYF	Energy Metering	150uF	25VDC	8x10.8
NSPE-H271M25V10X10.8NBYF	Energy Metering	270uF	25VDC	10x10.8
NSPE-H271M25V10X10.8NBYF	Gaming Machine	270uF	25VDC	10x10.8
NSPE-H101M35V8X10.8NBF	Energy Metering	100uF	35VDC	8x10.8
NSPE-H101M35V8X10.8NBYF	DSLAM	100uF	35VDC	8x10.8
NSPE-H151M35V10X10.8NBYF	RFID – HF Detector	150uF	35VDC	10x10.8
NSPE-H151M35V10X10.8NBYF	Power Source	150uF	35VDC	10x10.8
NSPE-H151M35V10X10.8NBYF	Gaming Machine	150uF	35VDC	10x10.8
NSPE-H151M35V10X10.8NBYF	DSLAM	150uF	35VDC	10x10.8
NSPE-H101M40V10X10.8NBYF	DSLAM	100uF	40VDC	10x10.8
NSPE-H101M40V10X10.8NBYF	Power Supply	100uF	40VDC	10x10.8
NSPE-H5R6M50V6.3X6.3NBYF	Lighting (LED)	5.6uF	50VDC	6.3X6.3
NSPE-H560M50V10X10.8NBYF	Motor Driver	56uF	50VDC	10x10.8
NSPE-H560M50V10X10.8NBYF	Lighting (LED)	56uF	50VDC	10x10.8
NSPE-H330M63V10X10.8NBYF	DSLAM	33uF	63VDC	10x10.8
NSPE-H120M80V10X10.8LBYF	Fork Lift	12uF	80VDC	10x10.8
NSPE-H100M100V10x10.8LBYF	Power Supply	10uF	100VDC	10x10.8

End Use Application Requirements by Capacitance & VDC

NSPE-T & -U

Industry	Application	Capacitance	Voltage
LED Lighting	Light Power	100uF	10VDC
Instrumentation	Battery charger	100uF	16VDC
Automotive	Radar Sensor	68uF	25VDC
AV	Digital Mixer Board	270uF	25VDC
Automotive	Electric Power Steering	330uF	25VDC
Automotive	Charger system for EV	47uF	35VDC
LED lighting	Freezer	100uF	35VDC
Automotive	Cooling Fan	150uF	35VDC
Automotive	Wiper	150uF	35VDC
Automotive	Anti-lock Brake System	150uF	35VDC
Automation	RFID - HF Detector	150uF	35VDC
Automotive	LED lighting	33uF	50VDC
Point Of Sale	Charger bar-cord reader	33uF	50VDC
Data Comm	POE Power Supply	33uF	50VDC
LED lighting	Garage light	22uF	63VDC
Audio	200W Power Supply	33uF	63VDC

Customer Information:... *48V side uses the LTC1871-1*

PoE application ... High cap with ESR less than 0.1 Ohm, current rating of >1.5A, rating of 63VDC (or higher)

LTC1871-1

DESCRIPTION



Wide Input Range, Boost, Flyback and SEPIC Controller ... Please note that the **input capacitor can see a very high surge current** when a battery is suddenly connected to the input of the converter and **solid tantalum capacitors can fail catastrophically** under these conditions. **Be sure to specify surge-resistant capacitors!**

NIC Suggested Device:

10 x 10.8mm SMT

NSPE-H330M63V10X10.8NBF

- ▶ 10K Hours @ 105°C
- ▶ ESR = 0.030 Ohm
- ▶ Ripple Current = 2100mA



Hybrid Advantage:

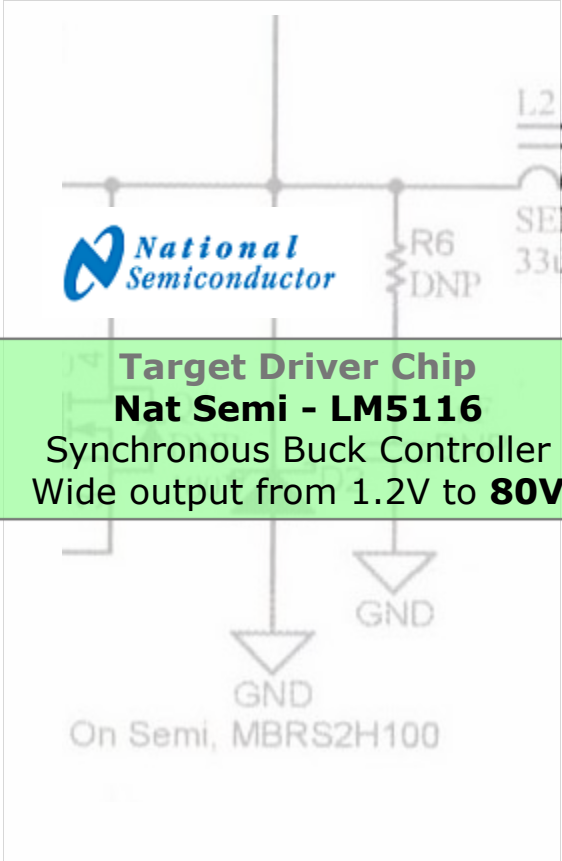
→ Ability to handle transient events without failing (Excellent inrush current characteristics)

Design Review

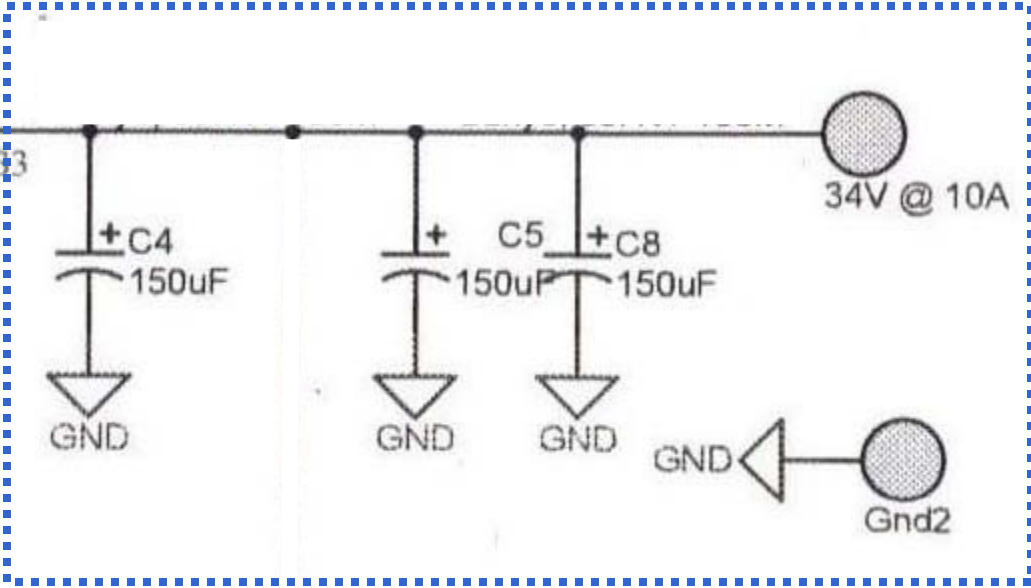


PN: NSPE-T151M35V10X10.8NBYF

150uF / 35VDC
34VDC, 10A (340W) Fan Driver



Target Driver Chip
Nat Semi - LM5116
Synchronous Buck Controller
Wide output from 1.2V to **80V**





Take-Away Points:

Practical case study examples of **hybrid capacitor** advantages

- ▶ **Outdoor circuits** use (requiring performance **at low temperatures**) the hybrid types has much lower ESR – Z [$>20X$ improvement over most commonly used liquid construction types at low temperatures]. This is seen as reduced ripple voltage (noise) at -20degC operation on output of voltage regulators (see pages 10 & 11 illustrating this advantage)
- ▶ **POE (Power over Ethernet) operation** at 48VDC is beyond VDC range of solid polymer types, but can be supported by hybrid types (rated up to 100VDC)
 - Customer Application Requirements: *High cap with ESR less than 0.1 Ohm, current rating of $>1.7A$, rating of 63VDC (or higher)*
 - Solution: NSPE-H330M63V10X10.8NBF; 33uF @ 63VDC, 10K Hour rating, ESR=0.030 Ohm, Ripple Current 2100mA
- ▶ **DC-DC converter applications** ... replacing multiple standard liquid electrolyte components with reduced number hybrid types. Example shows replacing eight liquid with three hybrid (see page 18)