NIC COMPONENTS CORP.

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Date: September 2015

Low ESR Solid Polymer Aluminum Electrolytic Capacitor

Sub: Application Guideline

NIC Series: NPC, NSP, NSPL, NSPX

GENERAL:

- When designing electronic circuits, always provide open or short failure mode protection
- Design redundant or secondary protection (when possible) in case of main circuit failure

VOLTAGE DE-RATING:

- Voltage de-rating is **not required** for this product
- Solid polymer aluminum electrolytic capacitors can safely be used, to rated voltage, over full operating temperature range

NIC Series	*Operating temperature range*
NPC, NSP, NSPL, NSPX	-55°C ~ +105°C

SURGE & OVER-VOLTAGE OPERATION:

- Do not apply voltage greater than rated voltage. Increased leakage current and or possible component damage (due to internal heating) may occur if compoent is subjected to over-voltage conditions
- Do not use multiple **series** connected parts (to increase voltage rating)
- Confirm the sum of the DC operation voltage (VDC) and peak AC ripple voltage do not exceed the voltage rating of the component

POLARITY:

- Component is marked for polarity; anode (+) polarity band
- Verify correct polarity before use
- Reverse bias operation may damage the component
- Review reverse bias conditions with NIC technical support at tpmg@niccomp.com
- Confirm the component is not revese biased under high AC ripple operation and low VDC operation

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RIPPLE CURRENT OPERATION:

- Do not exceed the ripple current rating (RCR) of the component
- See below example product specifications with ripple current corrected for operating temperature
- If unsure, please review your requirments (*i.e. ripple current conditions*) with NIC technical support at tpmg@niccomp.com
- Excessive AC ripple current will result in increased self-heating and possible damage to [or failure of] the component

STANDARD PRODUCTS AND SPECIFICATIONS

NIC Part Number	WV (Vdc)	Cap. (µF)	Max. LC (µA)	Tan δ	Max. Ripple Current +45°C & 100KHz (mArms)	Max. ESR +20°C & 100KHz (Ω)	Height H
NSP391M2.5D6ATRF	2.5	390	97.5	0.06	5,100	0.015	1.9±0.1
NSP391M2.5D6ZATRF		390	97.5	0.06	6,300	0.009	1.9±0.1
NSP391M2.5D6YATRF		390	97.5	0.06	7,500	0.006	1.9±0.1
NSP391M2.5D6UATRF		390	97.5	0.06	8,500	0.0045	1.9±0.1
NSP471M2.5D6ATRF		470	117.5	0.06	5,100	0.015	1.9±0.1
NSP471M2.5D6ZATRF		470	117.5	0.06	6,300	0.009	1.9±0.1
NSP471M2.5D6YATRF		470	117.5	0.06	7,500	0.006	1.9±0.1
NSP471M2.5D6UATRF		470	117.5	0.06	8,500	0.0045	1.9±0.1
NSP471M2.5D6VATRF		470	117.5	0.06	10,200	0.003	1.9±0.1

RIPPLE CURRENT TEMPERATURE CORRECTION FACTORS

Case Code	≤ +45°C	>+45°C ~ ≤+85°C	>+85°C ~ +105°C
All	1.0	0.7	0.25

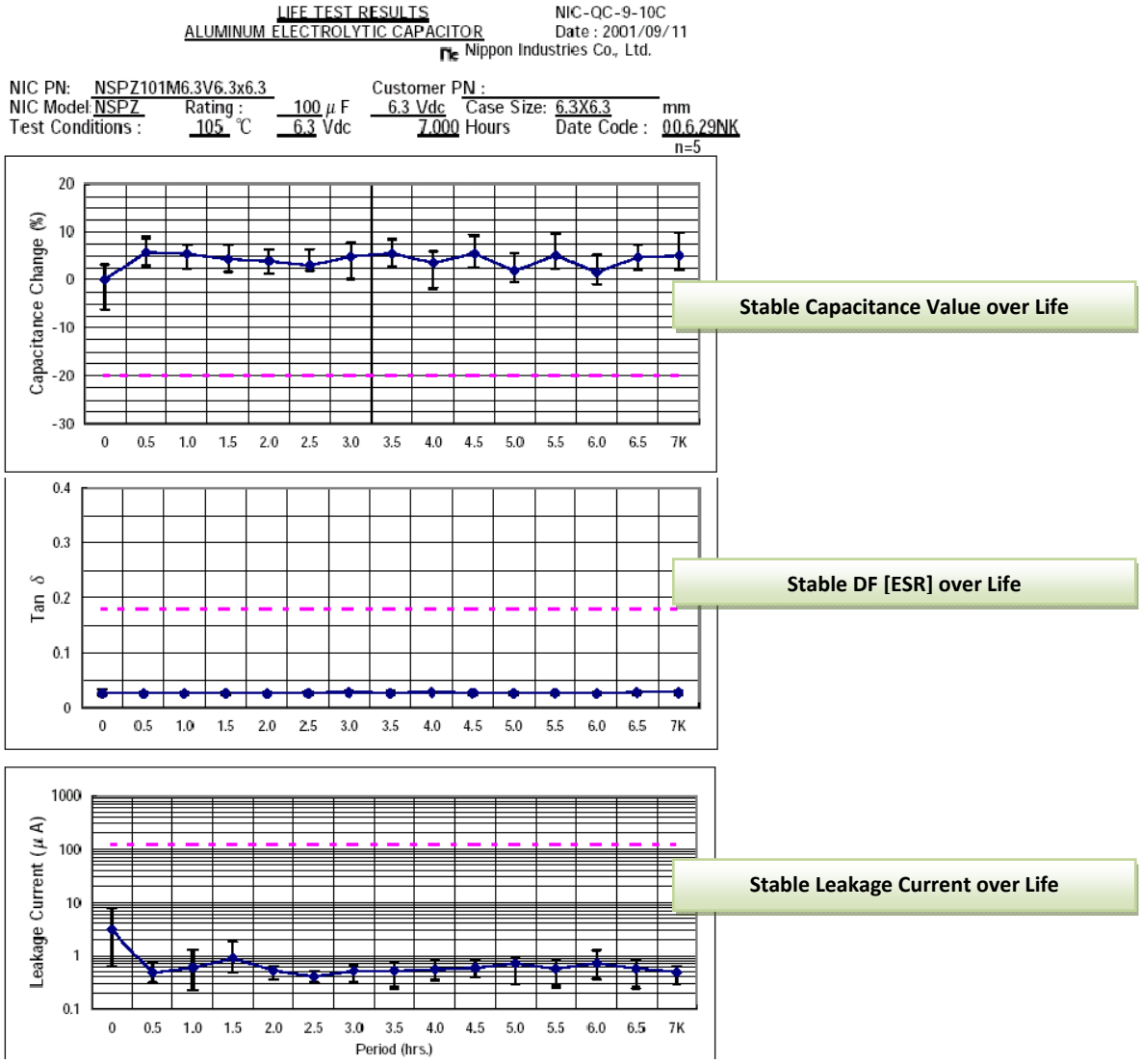
100KHz Ripple Current Ratings
10.2Arms @ +45C
7.14Arms @ +85C
2.55Arms @+105C

TIME CONSTANT APPLICATION:

- Do not use solid polymer aluminum electrolytic capacitor in time constant circuit or coupling application

FAILURE RATE ESTIMATION:

- Solid polymer electrolyte construction eliminates “dry-out” of liquid electrolyte (common to standard liquid electrolyte type) aluminum e-caps
- No degradation of operation over temperature or time (*see below typical performance data*)
- Additional life test data is supported, please contact NIC technical support; tpmg@niccomp.com



FAILURE RATE (FR):

- Calculated FR based upon MIL-HDBK-217F (USA)
- FR Influenced By:
    - Temperature Of Operation
    - Applied Voltage To Voltage Rating (Voltage Ratio Factor)
    - Capacitance Value Factor

FR = (BFR) **X** (Temperature Factor) **X** (Voltage Factor) **X** (Capacitance Value Factor)

BFR = Basic Failure Rate for Aluminum Electrolytic Capacitors (per MIL-HDBK-217F)

Temperature (°C)	Temp. Factor	Voltage Ratio	Voltage Factor	Capacitance Value (uF)	Capacitance Factor
+20°C	0.91	0.1	1	0.1	0.59
+30°C	1.1	0.2	1	0.5	0.85
+40°C	1.3	0.3	1	1	1
+50°C	1.6	0.4	1.1	3	1.3
+60°C	1.8	0.5	1.4	8	1.6
+70°C	2.2	0.6	2	18	1.9
+80°C	2.5	0.7	3.2	40	2.3
+90°C	2.8	0.8	5.2	200	3.4
+100°C	3.2	0.9	8.6	1000	4.9
+110°C	3.7	1	14		
+120°C	4.1				
+130°C	4.6				
+140°C	5.1				
+150°C	5.6				

EXAMPLE: (Based Upon Actual Usage Conditions)

NIC PN: NSP101M6.3TRD3TR [100uF / 6.3VDC]

Conditions: 6.3VDC & +25°C

Calculated FR = (0.00012) **X** (1.0) **X** (14) **X** (3.4) = 0.005712 / 1KKhrs = **5.7 FIT**

- Actual Acceleration Test Results @ Rated Voltage & Rated Temperature:
    - Total Test Time = 19,796,000 hours
    - Failures = 0
    - FR = (60% confidence; 0.917/T) = **46 FIT**

- Field Failure Reporting:
    - Total Test Time = 6,856,894,000 hours
    - Failures = 0
    - FR = (60% confidence; 0.917/T) = **0.13 FIT**